

# *Has product market competition reshaped returns to schooling in Mexico?*

EDUARDO RODRÍGUEZ-OREGGIA<sup>1</sup>

HÉCTOR MORENO MORENO<sup>2</sup>

DAVID MULATO MARTÍNEZ<sup>3</sup>

- **Abstract:** This paper analyzes the impact of product market competition on returns to schooling in Mexico, a country lagging behind in competition indicators and a complex labor market. With microdata from employment surveys, we first separate the premia for specific education levels at the industry level, and then pool them to link it with industry data for competition. Results show that product market competition has a positive effect on wage premia for high skilled workers, while there is no evidence for lower levels.
- **Resumen:** Este artículo analiza el impacto de la competencia de mercado sobre los retornos a la escolaridad en México, un país que se encuentra rezagado en indicadores de competencia y con un mercado laboral complejo. Utilizando microdatos de las encuestas de empleo, primero sepáramos el premio por nivel educativo en diferentes industrias, después las pegamos en un panel para relacionarlos con datos de competencia de mercado a nivel industria. Los resultados muestran que podría existir un efecto positivo de una mayor competencia sobre el premio salarial de trabajadores más calificados, mientras que no hay evidencia para los niveles bajos.
- **Key words:** product market competition, industry wage differentials, returns to schooling, Mexico.
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<sup>1</sup> Escuela de Graduados en Administración Pública (EGAP), ITESM, Campus Estado de México. Email: eduardo.oreggia@gmail.com. The authors acknowledge funding from the National Council for Science and Technology. We also acknowledge research help from Miguel Angel de Jesús Vázquez. Last, but not least, we would like to thank comments made by two anonymous reviewers. All remaining errors are our own responsibility. Corresponding Author: Eduardo Rodríguez-Oreggia.

<sup>2</sup> PNUD México, email: hector.moreno@undp.org.mx

<sup>3</sup> Cámara de Diputados, Email: dmulato@gmail.com.

## ■ *Introduction*

The labor market is affected by product market competition through several forms, but mainly through the level of employment, real wages, the capture of rents (Nickell, 1999), and also levels of labor protection (Amable and Gatti, 2004 & 2006). A number of studies has found a positive effect from competition on wages in developed countries (i.e. Griffith, Harrison and Macartney, 2007; Nickell et al, 1994; Jean and Nicoletti, 2002; Abowd and Lemieux, 1993; Blanchflower, Oswald and Sanfey, 1996; Blanchflower and Machin, 1996; Guadalupe, 2007, among others).

In spite of being one of the most open to trade countries in the world, Mexico lags among the OECD in product market competition indicators, and also in labor regulations (as reported in Conway, Janod, and Nicoletti, 2005). Annex 1 Figure A1 shows the mentioned indicators for years 1998 and 2003, where Mexico does not experience much advance on reducing burdens to competition, or labor protection, but rather the other countries implemented policies to improve their situation, which is reflected in the graphs.<sup>4</sup> This makes Mexico a country of interest for studying the effects of competition on the labor market.

Regarding the labor market, wage differential between more and less skilled increased during the pre NAFTA period due to technological change, but there is no evidence of increase in the gap attributable to more trade liberalization (Esquivel and Rodríguez-López, 2003). In Annex 1 Figure A2, we can see on average the evolution of the mean wages by education categories since 1988, where the gap seems to open before the entrance of NAFTA, but it is smooth after 1994, and coincident with the economic crisis at the end of that year and 1995. This trend is similar to that found for Mexico by Airola and Juhn (2005). However, there must be other element affecting such wages. For example, Mexico has put aside a large labor reform, only undertaking the pension reform of the private sector in 1997, leading to individual accounts and a reduction of payroll taxes, which had no large incidence on the formal sector (i.e. Garro, Melendez and Rodríguez-Oreggia 2005), and it also has experienced a large increase in the informal sector of the labor market, while the number of those covered by social security has remained stagnated in the last years (Cox-Edwards and Rodríguez-Oreggia, 2007). To what extent product market competition is affecting the labor markets remains an almost unexplored field in Mexico, and in general in Latin America.

<sup>4</sup> In 2003, Mexico is only surpassed by Turkey and Poland. As comparison, in 1998, Mexico was at the same level as Spain, Korea and Hungary, and surpassed by France, Italy, Greece, Czech Republic, Turkey and Poland.

A way to look for a possible effect from competition is the distribution of educational levels at industries more or less concentrated. This is shown in Figure A3 in the Annexes. In general, high competitive industries seemed to have a higher share of low skilled workers, but it reduces its share during the 1990s and the decade of 2000, but increased the share of high educated, but mostly those medium educated workers. Industries with medium competition environment decreased the share of low educated workers after 1994 and increased more the medium skilled workers. Low competitive industries also reduced their share of low educated workers but in a lower magnitude than other industries more competitive. That is, high competitive industries responded more to reduction on low educated share of workers and increased the share of more educated workers in the period of analysis.

This paper seeks to analyze the effects of product market competition in the different levels of returns to education in the manufacturing sector in Mexico. Using microdata from the National Employment Surveys, we follow a two stage strategy. In the first stage, we isolate the inter-industry differential in returns to education level for each sector and year, from 1988-2004. In the second stage, we pool such differentials and link with product market competition in a panel of data. The paper is structured as follows: section 2 outlines the theoretical framework of the analysis, while section 3 presents data and methodology, follow in sector 4 of the results and discussion, and finally conclusions are drawn.

- *Why does product competition matter in the labor market?*

According to Nickell (1999), there are three main effects through which product competition impacts the labor market. First, a higher product competition leads to more production and labor demand. This happens as the mark-up reduces, increasing labor demand at any wage level. Second, the labor supply elasticity gets smaller as product competition increases, and thus there is a reduction in the real bargaining wage. Third, the reduction in the labor demand elasticity leads to a higher capture of rents by those already in the labor market, which has an incidence in more permanent workers in jobs given a wage level.

Most of the studies have focused on the impact of competition on wages. Griffith, Harrison and Macartney (2007) used a panel of OECD countries to measure the impact of product market regulation on employment and wages. They find that the deregulation process during the 1990s led to a significant increase in competition, measured through the reduction in markups, and such increase in competition is related to

increases in aggregated employment and real wages. They also find that the higher the union density, the higher the effect on employment and the lower the effect on real wages. They tried to solve the endogeneity problem between markups and wages using policy reforms as instrument to product market competition. However, to the extent that policy reform may also be related to wages, such instrument is still correlated to the error term of the main wage equation.

Following the Dickens and Katz (1987), Katz and Summers (1989), and Goldberg and Pavnick (2003) processes, Jean and Nicoletti (2002) observe for a set of countries that anticompetitive regulations increase a general wage premia in all industries, but specifically in the non-manufacturing industries is that premia decreases as restrictions to the mechanism of market become severe, which is due to the effect of public ownerships. They instrument market power with anticompetitive product market regulation, which suffers the same problem of the instrument as Griffith, Harrison and Macartney (2007).

In Abowd and Lemieux (1993), wages are derived from a partial equilibrium with efficient bargaining between the industry and unions on employment and wages. They find that unions capture about 20 per cent of total quasi-rents per worker. They use as instrument for quasi-rents and negotiated wages, the price of exports and the price of imports in the industry. Nickell (1999) points that such instrument may be weak as deviation from price-taking by exporting industries would lead to an export price positively affected by wage shocks.

Other evidence finding positive effects of market power on wage include Blanchflower, Oswald and Sanfey (1996), Blanchflower and Machin (1996), and Guadalupe (2007). As Nickell (1999) points out, a big problem when analyzing market power and labor markets is the endogeneity problem and robustness of the models, remaining the problem of the use of instruments to be solved in a more accurate way, using himself two lags of market power to alleviate the problem to some extent.

Guadalupe (2007) specifically addresses how returns to skills change according to competition in industry in the UK. Using difference-in-difference, before and after the pound appreciation and the entrance of the European Single Market Program, she finds that competition has a causal effect on returns to skill and inequality; thus, skills are rewarded more, in relative terms, as competition increases. The reason argued for the impact of competition on returns is that if high skill workers produce at lower costs,<sup>5</sup> and as competition increases, firms also compete to

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<sup>5</sup> This argument is based on Vives (2004) and Boone (2000), where reduction of costs under

attract more skilled workers, leading to an increase in returns, which should lead to a differential in the inter-industry premia for the more educated. In this paper, we follow this line of research and try to measure to what extent competition has affected returns to schooling in more competitive industries in Mexico.

### ■ *Data and Empirical Framework*

The microdata come from the series of National Labor Surveys which started in 1987 and up to 2004 by the National Institute for Statistics, Geography and Informatics. These surveys covered only urban areas until 2000, thus we will use the urban section after that year. This is a quarterly survey recording information on socio-demographic characteristics of the individuals and households as well on all job features such as wage, hours worked, if the job is covered by social security, sector of activity, benefits, type of occupation, etc. The sample we use is for workers in manufacturing sector, 18-65 years old, in the private sector.

We are following the two stage methodology used in Dickens and Katz (1987), Katz and Summers (1989) and in Goldberg and Pavcnik (2003). In the first stage, we separate the specific wage premia for each industry, calculating a mincerian type wage equation in this form:

$$W_{ijt} = H_{ijt} \beta_{Hi} + I_{ijt} ip_{ji} + S_{ijt} \beta_{si} + (S_{ijt}^* I_{ijt}) isp_{ji} + \varepsilon_{ijt}$$

Where  $W$  is the log of real hourly wage for worker  $i$  employed in industry  $j$  in a year  $t$ .  $H$  is a vector of socio-demographic and household characteristics of the worker;  $I$  is a group of industry dummies where the specific worker is employed;  $ip$  are the coefficients capturing the effect of industry on the wage and that is not explained by other factors, or industry wage differentials;  $S$  are the levels of education of the worker;  $isp$  capture the inter-industry differential in returns to school in industry  $j$  at time  $t$  for level of education  $s$ , or additional industry returns to schooling differentials.

We will separate education levels in three categories.<sup>6</sup> Low education comprises no formal instruction and some primary school; medium education includes those with secondary and upper secondary levels; and high education takes into account those with some university.

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competition leads to a steeper sensitivity of profits to such cuts, thus the relative marginal product of hiring a more educated worker is higher.

6 This is to simplify the interactions with industry dummies. Guadalupe (2007) also uses three categories but based on occupational levels.

The coefficients  $isp$  are also normalized using the Haisken-DeNew and Schmidt (1997),<sup>7</sup> two stage restricted least squares for each year and clustering standard errors by industry. The sample includes workers in manufacturing sector, 18 to 65 years old, urban areas, and working the entire year, more than 20 hours per week and positive labor income. We use industry dummies at the two level digits, which gives about 48 industries and run the regressions for each year separately for the period 1988-2004. Variables to include in the vector  $H$  are experience and its square, and a set of dummies for: male, household head, married, nine geographic regions, size of firm, industry dummies, and eight occupations. Unfortunately, in the survey there are no questions regarding union status, for which we will try to account in the second stage at the industry level.

In a second stage, we pooled over time the  $isp$  normalized coefficients, relating them to measures of product market competition, through the model:

$$isp_{jt} = T_{jt}\beta_T + D_{jt}\beta_D + u_{sjt}$$

where  $isp$  are the normalized coefficients from the first stage.  $T$  is a vector of measures of product market competition in the industry  $j$  at time  $t$ .  $D$  is a vector of industry and year dummies. We will also account for serial correlation using the panel corrected standard errors with one lag. This model can be extended to include other variables affecting also the industry returns to schooling differentials. In addition, we can measure the effect of competition before and after the NAFTA including an interaction between those two variables, as the trade openness may have an incidence on the levels of competition.

For the first stage, we are using micro data from the National Employment Surveys, which are provided by the National Institute for Statistics, Geography and Informatics (INEGI). Basic statistics are presented in Appendix 2. We only use urban areas, as the survey also included rural areas but only since 2000. This survey included data for all socio-demographic characteristics of individuals and households, and a set of questions regarding their labor such as wage, hours worked, benefits, sector, occupation, etc. For the analysis in the

<sup>7</sup> Such normalized coefficients are interpreted as a point difference on the return to schooling for a worker in a given industry with a given level of education, relative to a mean worker in all industries with similar characteristics, and compared to low education levels. This process adjust variance covariance matrix of the normalized industry indicators with an exact standard error, correcting substantially the standard errors from the first stage.

second stage, we use product market competition data and also union share data.

The central variable for this analysis is the variable Competition, which is measured as the inverse of the CR4 (market share of the four biggest firms) two digits industry index calculated by INEGI using the Industrial Annual Surveys.<sup>8</sup> Nickell (1996) suggests that market shares may not be ideal for measuring concentration as, among other, do not fully reflect foreign competition, and using some industry digits may not represent something like a market. However, because of lacking better measures, he also suggests that such problems are reduced using panel instead of cross-sections data, and lags for the measure of concentration, in order to reduce the endogeneity problem, suggesting the use of 2 years lags, which we follow in this analysis.<sup>9</sup>

The variable NAFTA is a dummy accounting for the effect of the North America Free Trade Agreement started in 1994. Trade opening is supposedly to increase competition; however, there may be an effect of competition coming from foreign competition, and another thing is the internal competition, where Mexico is lagging according the above presented indexes. This exogenous variation may introduce an effect on internal competition through the effect of reducing the market share of industry and helps for identification in the results. But, on the other hand, it may also impact requirements of skills, as some precondition needed in a developing country must be required given that many industries may be comparative disadvantaged; therefore, we include this dummy to capture that effect.

We also include a measure for the unionization share in the industry, the variable Unions, with data provided by the Secretariat of Labor of Mexico using the National Surveys on Employment, Wage, Technology and Training, which is carried out unevenly and, therefore, we only have data for years 1995, 1999 and 2001, then we use the 1995 share for the period 1987-1995, the 1999 share for the 1996-2000 period, and the 2001 share for the 2001-2004 period. According to Fairris (2003), the power of unions has diminished in the last decade, so this variable may not be as important in the analysis.

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8 This measure is issued every five years; for that reason we calculated intermediate years with a splaine method using the Mathematica software in order to get intermediate years. The index ranks between 0 and 100, where 100 is perfect concentration.

9 Nickell (1996) also reviews the performance of possible and used instrumental variables, reaching the conclusion that lagging competition 2 periods is the best option, given the possible options, to address the problem.

It has to be mentioned that results should be carefully addressed as we are not controlling for unobserved individual characteristics of the workers. However, such problem is far from being settled, for example, as raised by Murphy and Topel (1987) and Gibbons and Katz (1992), but showing mixed results when empirically applied; but mostly it has been found that although such characteristics can not be rejected, its contribution to the observed differentials seems to be limited (Martins, 2004; Plasman, Rycx and Tojerow, 2006).

### ■ *Results*

In Table 1 we can find results for some selected years for the first stage. It is calculated with OLS and clustering standard errors by industry.

In general, we find the expected sign for all the variables. With the exception of the self-employed dummy, which is inconstant through time, all variables are significant. The wage increases with the education levels and experience, while squared experience is negative. Males have a positive premia respect to females, and also household head relative to non heads, and with same situation for married. But the main interest from this first stage is to take all the *isp* coefficient in order to normalize them as explained above and pool them for the second stage process.<sup>10</sup>

Table 2 shows results for the second stage of the panel data, with dependent variable being the normalized coefficients *isp* of the inter-industry education level premia differential. We use panel data technique with panel corrected standard errors,<sup>11</sup> and weighting by the inverse of standards errors from the first stage to control for additional heteroskedasticity. We include a set of industry and year dummies to control for unobserved industry and temporary shocks. Table 2 presents results for all the levels (high and medium education), and separating high and medium levels of education.

In the first panel, for all levels of education, we find a positive and significant impact of competition on additional industry returns for levels relative to low education. Relative to low education level, if competition increases in one percentage point, the additional returns to school levels will increase between 0.016 and 0.019 wage log points. The variable NAFTA is positive and significant, meaning additional returns for the manufacturing sector during this period. Moreover, we also include an interaction between Competition and NAFTA, in order to measure if

10 About 93% of all those interactions are significant.

11 Wooldridge test rejects the null hypothesis of no autocorrelation. In addition, Hausman tests point to fixed effect models in all cases.

Table 1

OLS Results (selected years)		1988	1990	1992	1994	1996	1998	2000	2002	2004
Medium	0.469 (0.014)***	0.271 (0.020)***	0.161 (0.015)***	0.222 (0.012)***	0.35 (0.012)***	0.392 (0.009)***	0.752 (0.015)***	0.196 (0.013)***	0.352 (0.016)***	
High	0.798 (0.019)***	0.399 (0.020)***	0.524 (0.016)***	0.72 (0.019)***	0.85 (0.023)***	0.558 (0.022)***	1.003 (0.015)***	0.613 (0.017)***	0.447 (0.028)***	
Experience	0.019 (0.001)***	0.022 (0.001)***	0.021 (0.001)***	0.02 (0.002)***	0.019 (0.001)***	0.016 (0.001)***	0.014 (0.001)***	0.014 (0.001)***	0.014 (0.002)***	
Experience Sq	-3.06E-04 (0.000)***	-3.40E-04 (0.000)***	-3.18E-04 (0.000)***	-3.11E-04 (0.000)***	-3.01E-04 (0.000)***	-2.51E-04 (0.000)***	-2.26E-04 (0.000)***	-2.33E-04 (0.000)***	-2.49E-04 (0.000)***	
Self employed	0.099 (0.041)***	0.103 (0.030)***	0.104 (0.025)***	0.084 (0.025)***	-0.001 (0.025)***	0.024 -0.028	-0.002 -0.026	-0.006 -0.033	-0.03 -0.028	
Male	0.129 (0.027)***	0.153 (0.031)***	0.071 (0.031)***	0.084 (0.023)***	0.078 (0.018)***	0.087 (0.017)***	0.108 (0.014)***	0.124 (0.016)***	0.132 (0.012)***	
HH Head	0.113 (0.015)***	0.112 (0.012)***	0.127 (0.014)***	0.113 (0.015)***	0.117 (0.014)***	0.112 (0.007)***	0.121 (0.008)***	0.096 (0.009)***	0.114 (0.012)***	
Married	0.078 (0.011)***	0.087 (0.012)***	0.086 (0.012)***	0.094 (0.008)***	0.078 (0.011)***	0.092 (0.007)***	0.074 (0.008)***	0.06 (0.006)***	0.074 (0.008)***	
Constant	1.817 (0.045)***	2.035 (0.066)***	2.456 (0.033)***	2.158 (0.048)***	1.918 (0.048)***	1.964 (0.029)***	1.838 (0.037)***	2.325 (0.036)***	1.855 (0.036)***	
N	12548	13157	18749	19631	21081	26123	35646	30816	16920	
R-squared	0.36	0.4	0.38	0.41	0.45	0.46	0.43	0.44	0.39	

\* significant at 10%, \*\* significant at 5%, \*\*\* significant at 1%

Standard errors clustered by industry.

All regressions include controls for nine regions, industry dummies, size of firm, nine occupations and interactions between education and industry.

**Table 2**  
**Panel Data Second Stage Outcomes**

<i>All education levels</i>	(1)	(2)	(3)	(4)
Competition	0.016 (0.004)***	0.016 (0.004)***	0.019 (0.004)***	0.019 (0.004)***
NAFTA		0.207 (0.006)***	0.151 (0.024)***	0.150 (0.024)***
Unions		-0.224 (0.233)	-0.136 (0.243)	
Competition*NAFTA			0.024 (0.010)**	0.024 (0.010)**
<i>Only high education level</i>	(5)	(6)	(7)	(8)
Competition	0.022 (0.005)***	0.022 (0.005)***	0.027 (0.004)***	0.027 (0.004)***
NAFTA		0.202 (0.008)***	0.237 (0.033)***	0.236 (0.029)***
Unions		-0.205 (0.293)	-0.039 (0.305)	
Competition*NAFTA			0.044 (0.013)***	0.045 (0.013)***
<i>Only medium education level</i>	(9)	(10)	(11)	(12)
Competition	0.008 (0.005)	0.008 (0.005)	0.007 (0.005)	0.007 (0.005)
NAFTA		0.244 (0.010)***	0.261 (0.024)***	0.254 (0.024)***
Unions		-0.233 (0.206)	-0.262 (0.207)	
Competition*NAFTA			-0.008 (0.009)	-0.007 (0.009)

Observations: N(All)=1632 N(High)=816 N(Medium)=816

All regressions include industry and year dummies.

Panel corrected standard errors in parentheses

\* significant at 10%; \*\* significant at 5%; \*\*\* significant at 1%

trade openness had an incidence on how more industry subject to more competition have an addition return for more skilled workers. The coefficient of the interaction is positive and significant, thus the premia to more skilled workers has increased further after the NAFTA in more

competitive industries. Union is not significant, which is consistent with previous findings by Fairris (2003), where they have lost power in the last years.<sup>12</sup>

The second and third panels of Table 2 show results for high and medium education levels. Competition is significant and positive for high education, but is not significant for medium levels. The interaction for competition and NAFTA is also significant for high levels, but not for medium. From this, it seems that the differentiated premia for education derived from more competition is concentrated in the high education levels only. Unions are not significant at any level, which is in accordance with findings by Fairris (2003) for Mexico, as unions have faded their power to affect labor welfare in the last years.

The fact that more competition rewards the more skilled workers with an extra premia for education also has implications in inequality, as the gap between skilled and less skilled in more competitive industries could increase, although in general still remains the issue of analyzing the general impact on inequality. This is to some extent consistent with findings by Airola and Juhn (2005), where using Income-Expenditure Surveys for Mexico they find that wage inequality increased in the first part of the 1990s, but slowing down after, although they do not consider the impact of competition.

### ■ *Conclusions*

This paper has sought to link product market competition with returns to more skilled workers in Mexico. Using data from the National Employment Surveys, we used a two stage procedure to make such a link. In the first stage, we separate the specific premia to more skilled in industries in the period 1984-2004, while in the second we pooled such premia and use panel data techniques to measure the effect of competition on those returns.

Results show that competition has an incidence in increasing returns in industries exposed to higher competition. However, when separating the effect between levels of education, the effect is only found at the higher education level, but not in the medium levels. This may be happening as industries more exposed to competition seek to reduce costs while increasing productivity, thus competing also to attract more skilled worker for which they apply an additional wage premia, leading

12 A referee has also suggested that another explanation is that this happens due to the way we are measuring unionization. To the extent that the distribution of unionization remains unchanged for most of the period may explain the lack of significance.

also to more inequality in labor income. Since Mexico is a highly unequal country with a rigid structure for competition and labor regulations, this study has shed some light on the response of the industry to more competition and its effect on the labor market.

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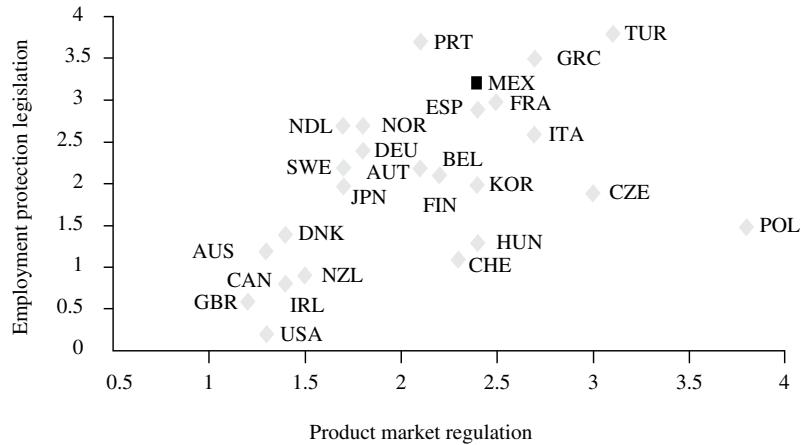
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■ Appendix 1

Figure A1

Panel A, 1998



Panel B, 2003

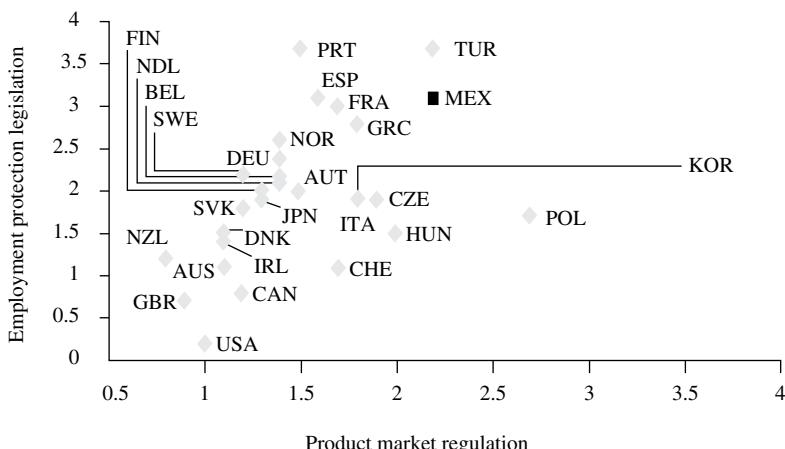
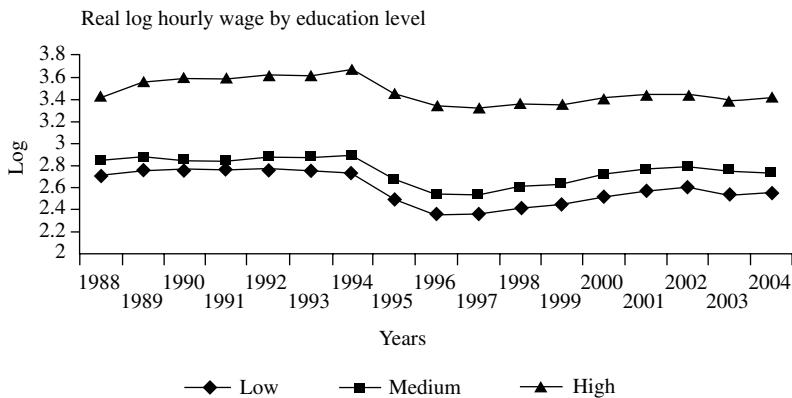


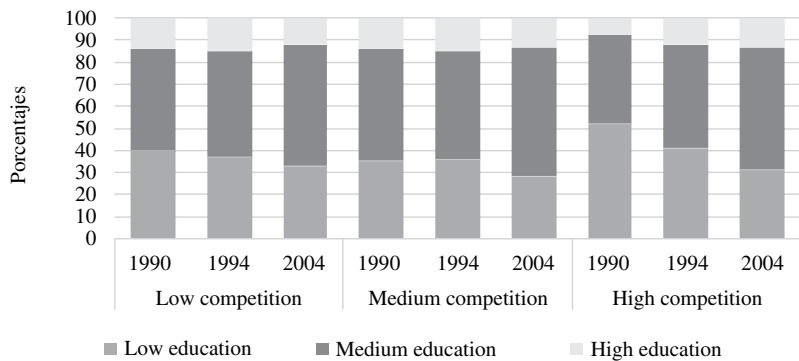
Figure A2



Source: Own calculations using the National Employment Surveys. High education includes university studies, medium includes lower and upper secondary, and low education include primary and no education.

Figure A3

Education attainment and the competition level in industries



Source: Own calculations using the National Employment Surveys. High education includes university studies, medium includes lower and upper secondary, and low education includes primary and no education. High competition is taken the inverse of the CR4 average plus 0.5 standard deviations, medium competition is the average+0.5 st.dev, and low competition is average minus 0.5 std. dev.

■ *Appendix 2*

Table A1

## Descriptive Statistics (selected years)

	1988	1990	1992	1994	1996	1998	2000	2002	2004
Age	31.78	31.57	31.97	32.62	32.60	32.28	32.67	33.73	34.07
Experience*									
(years)	17.64	17.10	17.22	17.47	17.32	16.82	17.23	18.13	18.72
Male	73.63	73.09	73.84	73.18	71.26	69.59	68.04	69.06	68.08
Married	57.74	56.72	59.23	61.54	61.49	62.15	61.88	62.94	61.95
HH Head	50.40	49.33	50.82	51.83	50.32	49.99	49.22	51.13	49.66
Low	46.38	42.40	39.09	37.54	35.90	33.08	31.81	30.37	28.9
Medium	42.45	45.43	46.98	47.88	49.27	52.01	52.32	53.07	53.8
High	11.17	12.17	13.94	14.58	14.84	14.90	15.87	16.57	17.3

Workers 18-65 years old, working the whole year, in manufacturing private sector, working more than 20 hours per week with positive labor income and in urban areas.

Note (\*) In years.