Changes in wage structure in Mexico going beyond the mean: An analysis of differences in distribution, 1987-2008.

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Abstract

This paper examines empirically the relation between wage inequality, employment structure, and returns to education in urban areas of Mexico during the past two decades (1987-2008). Applying quantile decomposition approach proposed by Melly (2005), we point out that the changes in wage inequality have been mainly driven by variations in educational premia. Furthermore, we find that some changes in employment structure such as occupation and firm size played an important role. This evidence suggests that changes in wage inequality in urban Mexico can hardly be interpreted in terms of a skill-biased change, but as a result of the increasing demand for skills during that period.

JEL classification: J31
Keywords: Wage Inequality; Quantile Decomposition

1. Introduction

In this paper, we examine the changes in the wage structure in urban Mexico across the entire wage distribution over the past two decades (1987-2008). We use quantile regressions to check whether the entire wages distribution is affected uniformly by human capital variables, demographic and labor characteristics.

The Mexican case emerges as an interesting outlier in the relation between changes in wage inequality and schooling premia in the international context. For this reason, we also focus our attention on changes in returns to various characteristics over the analysed period.

The paper is structured in two different parts: First, using the National Survey of Labor and Employment (ENOE) and the National Urban Employment Survey (ENEU), both carried out by the National Institute of Statistics and Geography of Mexico (INEGI), for the period 1987-2008, we identify which forces have played a role for variations in schooling returns and wage inequality. Second, we apply the quantile decomposition methodology developed by Melly (2005) that permits us to decompose the changes of the wage distribution into changes in covariates, coefficients, and residual components. These results are based on the estimation of a standard mincerian wage equation, where levels of education, experience, gender, marital status, occupation, activity sector, firm size, economic sector and urban areas are included as covariates. One advantage of the procedure is that it provides a way of separating the between- and within-group components, as in a variance decomposition. This plays an important role in the inequality literature, since Jun, Murhpy and Pierce (1993) conclude that most part of the inequality growth from the 1980s to the 2000s was linked to the residual inequality component. In fact, quantile regression analysis reveals whether the effects of many covariates are constant or not across the wage distribution. Our results show that increases in returns to covariates across the entire distribution were the driving forces behind the wage changes in the considered period. Further, the decomposition method proposed in Melly (2005) allow us to evaluate the role of changing labor force composition (in terms of workers

characteristics) and changing labor market in overall changes in the wage distribution between 1987 and 2008. We do not pretend to establish causality between the structural changes that happened during that periods and the evolution of wage inequality, but this analysis will help to identify the direction of change throughout the two decades across the entire wage distribution. For instance, our results show that changes in the composition of the work force in urban Mexico contributed positively to wage growth during 1987-1994, but negatively during 1995-2000.

As we describe below, important changes took place over the analyzed period. In particular, the Mexican economy underwent numerous reforms—domestic financial market reforms, capital account liberalization, tax reforms, privatization of state-owned enterprises and labor reforms (Lustig, 1998, 2001). Two key events often discussed in the literature are the signing of GATT (General Agreement on Tariffs and Trade) in 1986 and NAFTA (North American Free Trade Agreement) in 1994. First, in the mid 1980s, Mexico started an important opening up process in which it adopted an aggressive policy of trade liberalization and other reforms related to privatization and deregulation, but this process was particularly intense in 1987 and 1988. After that, Mexico cross the stabilization period (Hanson et al., 1999) and the corporate tax policy in Mexico was reformed in order to lower distortions on investment. Second, most studies analysing the second half of the 1990s have argued the relevance of the peso devaluation in December 1994 and the 1995 crisis, the most severe economic crisis that Mexico has witnessed since the 1930s. Yet, later that year a recovery, which solidified in 1996 and 1997, was already under way, Mexico's government implemented different anti-poverty policies. After that, in 1998, Mexico was hit by several external shocks that pushed the economy[1] into lower than expected growth and higher than expected inflation[2]. Capital inflows were reduced and the price of oil dropped sharply in international markets. This situation negatively affected Mexico's public finances and the budget

[1] In 1998, the Mexican authorities responded with the proper fiscal and monetary policies to contain the adverse effects of these developments.

[2] On the inflation, Mexico finished the year with a rate of 18.6 % when the target was of 12 %. Other prices as the interest rates (Cetes rate and the average interbank interest rate (TIIP)) were higher in 1998 than in 1997, many factors contributed to the exchange rate changed and the volatility exhibited by this indicator for most of 1998.

deficit target, announced at the beginning of the year, was 1.25% of GDP. Moreover, the portfolio investments received by Mexico in 1998 decreased relative to the previous two years. The final outcome of this situation is that for the period 1987-2008, income and wage inequality followed an inverted-U shape pattern (Lopez-Calva and Lustig, 2010; Esquivel, Lustig and Scott, 2010).

Taking into account these previous studies, in order to carry out our study, we will break the two decades into three distinct periods. The first period, 1987–94, was marked by structural reforms and trade and financial liberalization in the economy, rising the relative demand for skilled labour and also rising inequality. The second period, 1994–2001, was one of growth and relative stability and an increasing supply of skilled workers and, a decrease in inequality. Moreover, in this period the levels of education clearly increased. In the third period, 2001-2008, other reforms were subsequently introduced. These reforms entailed changes in labor force composition, in terms of education and experience (Lopez-Acevedo 2006), in terms of supply and demand of labor (Campos-Vazquez 2010), effects of trade (Robertson 2007), expansion of government monetary transfers target to the poor, rise on the share of remittances and the fall in the skill premium among skilled and unskilled workers. Besides in the late 1990s urban informal labor was a relevant part of employment, many studies reported levels of the urban informal rate oscillated between 20 and 40 %. Later on the OECD (2007) reports levels of 62% considering agricultural non-agricultural employment. Finally, from 2005 to 2009, Mexico has experienced small rates of growth real GDP[3] and the recession in the United States felt most immediately in the country.

To explain the changes in wage structure standard economic theory focuses on the average wage dynamics rather than on the changes across the entire wage distribution, ignoring the differences at the bottom or at the top of the wage distribution. With regard to Mexico, changes of wage structure display interesting patterns in the level of wage at different portions of the wage

[3] Since 2006 the rate reduced from 4.7 to 2.0 in 2008, United Nations (2009).

distribution between 1987 and 2008.[4] Furthermore, average wages may miss important features of the wage structure, and it is important to go beyond averages to present a complete picture for three reasons. First, because recent work for other countries using quantile regression techniques have shown that attributes have different effect on wages of the individuals at the top of the wage distribution when compared to individuals at the bottom of the wage distribution.[5] Second, because Mexico is a heterogeneous society and, for this reason, the effects of reforms can be heterogeneous as well. Third, because there is growing evidence from other countries (e.g., the US) that suggests that, far from being ubiquitous, the growth in wage inequality is increasingly concentrated in the top end of the wage distribution (Lemieux, 2007).

Taking all this into account, this paper contributes to the existing literature in the following ways First, we estimate earning functions across the entire wage distribution using quantile regression, and quantify the contribution over time of changes in the individual covariates' of worker living in the urban areas of Mexico. Second, we decompose the change in wages in the past two decades into a part that is attributable to changes in prices (coefficient effect), changes in characteristics (covariate effect) and residual components across the entire wage distribution. The Melly (2005) decomposition is well-suited to depict heterogeneous characteristics, coefficients such as *between effects* and residuals *within effects* across the entire wage distribution. The idea is to perform simulations between periods and an aggregate decomposition analysis using a conditional procedure. The comparison of the effects for the different quantiles show that differences in characteristics are much more important at the bottom (10^{th} centile) than at the top (90^{th} centile) of the wage distribution. Indeed, some significant wage structure effects emerge at the 90^{th} percentile.

[4] For additional details about the ratio of real hourly wage see Tello, 2011. And the evidence to other periods of time Robertson, 2000; Lustig, 2001; Lçopez-Acevedo, 2006 and Campos-Vazquez, 2008.

[5] The evidence for this comes from a number of different countries such as the USA (Buchinsky, 1994), Germany (Fitzenberg and Kurz, 2003), Uruguay (González and Mile, 2001), Zambia (Nielson and Rosholm, 2001), in Chile (Beyer, Rojas, and Vergara, 1999), in Morocco (Currie and Harrison, 1997), in Costa Rica (Robbins and Gindling, 1999) and Colombia (Robbins, 1996). In India Kijima (2006) decompose the changes in the 90th-10th, 90th-50th, and 50th-10th percentile of log wage differential and Portugal (Machado and Mata, 2000).

Third, we extend the period of analysis of previous literature through 2008 by incorporating new data.

The rest of the paper is structured as follows. Section 2 reviews the previous literature. Section 3 introduces the empirical strategy and the data used for our analysis. Section 4 examines, first, the results for wage inequality over time using quantile regression technique and, second, the results of the decomposition results. Section 5 concludes.

2. Literature review

Considering the connections between education and inequality, the evidence points out that in Mexico rising educational wage differential have been important aspects of rising wage inequalities. Research has taken variety of directions to capture the patterns of change in wage inequalities examining education acquisition and inequality; the labor market returns to education and the contributions of increased education demand and supply.[6] And under certain circumstances education reinforces already existent inequalities and results in increased inequality. In other circumstances education provide the route out of disadvantage by enabling people from poorer backgrounds to escape poverty.[7] In the 1990s, Mexico experienced educational achievements and the distribution across the labor force changed substantially; in addition, the gap between wages of more educated workers and workers with little education fell systematically and the changes in the returns to education accounted for a significant share of the rise in household per capita income inequality. In contrast with this in the 2000s declines in labor earnings inequality appear to be associated with less steeper returns to education functions, which reduced earnings per worker inequality and much less so –or not at all- to changes in employment patterns. However, an examination of the changes in the composition of the labor force by education and experience and

[6] See Cragg and Epelbaum, 1996; Meza, 1999; Cortés, 2001; Airola and Juhn, 2001; Boullion et al 2004.
[7] See Calva and Lustig, 2009 and Esquivel, et al., 2010.

the corresponding relative wages suggests that supply-side factors must have been important as well the demand (Duryea and Székely, 1998; Legovini et al., 2005; Lopez-Acevedo, 2006; Campos-Vazquez, 2008; Esquivel, 2009; Esquivel et al., 2010).[8] Other avenues have measured the interaction between educational endowments and earnings inequality in Mexico (see e.g. Legovini et al. 2005; Lopez-Acevedo 2006; De Hoyos, 2007; Campos-Vazquez, 2008 and Esquivel et al., 2010). However, from our point of view, in order to understand the relationship between human capital accumulation and changes in the wage structures it is necessary to go further the conventional approach based on the analysis of average wages and its determinants using least square methods. In particular, first, it is necessary to analyze the impact of human capital variables on the entire wage distribution, and not only for average data; and, second, it is necessary to decompose the changes of the wage distribution into the effects due to different components.

The most influential studies of income decomposition through Mincer equations are Oaxaca (1973) and Blinder (1973) and after them Juhn, Murphy and Pierce (1993)[9]. Fortin et al. (2010) sum up an interesting overview of decomposition methods that have been developed since the seminal work of Oaxaca and Blinder in the early 1970s. Another regression-based approach is also found in two papers by Bourguignon and co-authors (Bourguignon and Martinez, 1997; Bourguignon, Fournier, and Gurgand, 1998). The essence of their procedure is to run two regressions for a base year 1 and a final year 2 and then to decompose the changes in price, quantity, and residual

[8] Legovini et al. (2005) looked only at the period of rising inequality, 1984–94; they found that changes in the levels of and returns to education account for about two-fifths of the increase in inequality. De Hoyos's (2007) paper looks only at the level of inequality in any given year and one of his findings attribute about 20% of the inequality in household income to uneven distribution of endowments. The focus of the De Hoyos and Legovini et al. papers are household and household per capita income, rather than individual earnings. Lopez-Acevedo (2006) covers a longer time horizon, and examines individual earnings; the author found changes in relative earnings among education groups to be the key explanation for changes in inequality in the urban areas of Mexico. Campos-Vazquez (2008) analyzes the change in inequality over time; the paper attributes the decrease in wage inequality to lower returns to education, while Esquivel et al. (2010) attribute the decrease in income inequality to a decline in skill premiums, which in turn are associated with a fall in the share of unskilled workers in the labor force.

[9] The Jun, Murphyan Pierce method is similar to Oaxaca type decomposition analysis of wage differentials, since Oaxaca type decomposition analysis also decomposes wage differentials into a coefficients effect (usually labeled as discrimination), a characteristics effect, and a residuals effect. However, unlike Oaxaca type decomposition analysis of wage differentials, the JMP method provides coefficients and characteristics effects only at an aggregate level. As shown above, the JMP method provides coefficients and characteristics effects only at the aggregate level, while the Fields method provides contributions of individual factors to the differences in earnings inequality without decomposing them into coefficients and characteristics effects..

effects.[10] Machado and Mata (2005), Melly (2005) and Autor et al. (2005), derive counterfactual wage distributions, using alternative set of covariates, coefficients, and residuals. In such a way, the changes over time of the wage distribution are decomposed into price (coefficients), quantity (covariates), and residual (within) effects. These methods are based on conditional quantiles and keep to the strong assumptions that are necessary to economic interpretations[11].

In line with latter approach, we investigate the relation between employment structure and wage inequality in Mexico, arguing that the changes in the trend observed for wage inequality in the last two decades is actually the result of countervailing effects, which are related to changes in covariates (employment structure), coefficients (educational wage premia and other characteristics), and residuals.

The international evidence shows that the large shifts in labor force composition have the potential to contribute to the divergent behavior of upper and lower tail inequality. For example, the real minimum wages, declining unionization, and monotonically rising demand for skill do not generally predict steadily increasing upper-tail inequality paired with fluctuating lower tail inequality. Consequently, this lead to suppose that the earnings follow new trajectories may tend to fan out become more dispersed and the changes in the distribution of education or experience of labor force may give rise to changes in earnings dispersion. Autor et al., (2006) find that changes in labor force composition in USA do not contribute to an explanation for the diverging path of upper and lower tail inequality in the past two decades. The composition hypothesis fails for two reasons: First, we show that the impact of changes in labor force composition on wage dispersion occurs almost entirely below the median of the earnings distribution (i.e., in the lower tail). This in turn implies that the steady growth of upper-tail inequality during the 1980s and 1990s is due to

[10] A different school of thought abandons entirely the regression framework and examines between-group and within-group inequality (see, Cowell and Jenkins, 1995). A quite different type of decomposition comes from the factor components literature. Fei, Ranis, and Kuo (1978) and Pyatt, Chen, and Fei (1980) decomposed total inequality into terms attributable to each factor component (e.g., labor income, capital income, land income). Fei, Ranis, and Kuo showed that the Gini coefficient of total income can be decomposed into a weighted sum of *pseudo-Ginis*, the weights being given by the corresponding factor shares.

[11] The most relevant assumptions are *additive linearity* and *conditional rank preservation*. For more details see Fortin, Lemiux and Firpo (2010).

changing labor market prices, not mechanical effects of composition. Apart from during the 1980s, increasing lower tail inequality appears explained by changing labor market prices, augmented slightly by shifts in composition. In the 1990s, by contrast, changing market prices generated considerable compression in lower tail inequality, but these price effects were in substantial part offset by compositional shifts (which would otherwise have caused lower tail inequality to increase). The source of the asymmetric rise in earnings inequality with a steady rise in upper-tail wage inequality and some evidence of flat or declining lower-tail wage inequality suggests a "polarization" of the labor market with a particularly strong market for workers in the top part of the skill distribution, deterioration in market conditions for workers in the middle, and reasonably steady market conditions for those near the bottom.[12] And Goos and Manning (2007) conclude that the hypothesis of skillbiased technical change (SBTC) is only a partial truth and cannot explain all of the important changes in the labor market, in other words SBTC hypothesis seems best able to explain what is happening in the top half of the wage distribution but not its bottom half. They emphasize that new technologies are substitute to routine tasks, located in the middle of the wage distribution, and are complementary to non routine cognitive and manual tasks, located respectively at the top and at the bottom of the job quality distribution.[13] These interpretations have not been easily extended to Mexico, where different degrees of adoption of new technologies and labour market institutions have produced a different wage dynamics with respect to Anglo-Saxon countries (Gottshalk and Smeeding, 1997).

Nowadays, the empirical evidence concerning the analysis of the wage inequality using quantile regressions and decomposition techniques in Mexico is limited. López-Acevedo (2006) uses the Labor Force Survey from 1988 to 2002. She reviews the relation education and inequality and examines the evolution and structure of the rates of returns to education by means of ordinary least

[12] Goos and Manning (2003) call such a process the "polarization of work," and argue that it may have contributed to a similar hollowing out of the wage distribution in the United Kingdom during 1975 to 2000.

[13] Hence, the technological change favours the employment growth for cognitive tasks in high paid jobs as well as for manual tasks in low paid jobs, while it decreases the employment in middling jobs where routine tasks are used. In this framework, the new technologies would be responsible for the increase in the upper tail wage inequality (the 90/50 index) and for the decrease of the lower tail inequality (the 50/10), observed for instance in the US case.

squares and quantile regressions without decomposition. López-Acevedo finds that in the early 1990s the trends in the distribution of earnings in Mexico differ from the trends in the distribution of current income in two ways. First, the gains are not limited to the richest 10 percent, as those in the seven-, eight-, and nineteenths of the distribution improved their relative earnings. Second, the distribution of earnings clearly worsened in the 1990s until 1996, although the inequality associated with total current income was moderately stable in the 1990s, displaying an improvement after 1996. Differences in the behavior of total current income and labor earnings inequalities from 1994 to 1996 support the idea that the poor, who rely the most on labor as a source of income, are the least able to protect themselves during a recession. Moreover she concludes that the education is a key variable for our understanding of income and earnings inequality in Mexico. Education is by far the variable that accounts for the largest share of earnings inequality in Mexico, in terms of both its gross and its marginal contribution. The marginal contribution of education to the explanation of inequality in Mexico is almost equal to the joint contribution of other relevant variables such as age, economic sector, labor market status and hours worked. It is worth pointing out that the difference between the gross and marginal contributions has been increasing over time, indicating that, as the economy progresses, education becomes even more important in determining the choices of sectors and occupations. Campos-Vazquez (2008) reviews the sources of the fall in wage inequality and job polarization in the period post-NAFTA using the Mata and Machado (2005) and Bound and Johnson decompositions (1992) with quantile regressions[14]. Campos-Vazquez found that the main reasons to explain why inequality has fallen are related to supply and demand forces; the slower demand growth and the increase in supply of college workers was not matched by an increased in top qualified jobs. [15] The results of the decomposition show that the returns to education and labor experience are the most important factor explaining the decrease in wage inequality. The decline in returns is explained by a substantial increase in college graduates in the last 10 years, but it is also

[14] The empirical application that Campos-Vazquez uses is Expenditure Survey (ENIGH) and only control by education groups, experience, gender and regions.

[15] Arias et al. (2001) review the returns to education and quantile regressions using instrumental variables and treatment effects concentrate their research in the effect of the education on the whole conditional distribution earmings.

due to slower growth in labor demand, especially for the top paid jobs. These results confirm that changes in relative supply are the main determinant behind the decrease in wage inequality. Sámano (2010), analyses the income inequality in Mexico using the hierarchical approach (Atkinson, 2007) and the decomposition method proposed by Machado and Mata. She reviews groups of workers with high levels of education and occupations that are related with the new technologies. She found relevant differences among deciles, in particular in the bottom deciles.

3. Data and methodology

3.1 Data

As mentioned in Tello (2011), the empirical analysis is based on the National Survey of Labor and Employment (ENOE) and the National Urban Employment Survey (ENEU) carried out by the National Institute of Statistics and Geography of Mexico (INEGI). In this paper, we analyze the wage structure and the decomposition analysis from 1987 to 2008. The analysis was carried out for 38 urban areas (localities with at least 2.500 inhabitants), although information was collected for 48 different regions. However, as they were changing in different points of time hence we have only considered 38 time invariant regions for the sake of comparability. The sample consists of employees aged 15-65. We focus on employees with permanent jobs that working regularly full-time and the hours are measured using usual hours worked in the principal job. We refer to the real hourly wage in logarithms, obtained by dividing the monthly wage from employment (earnings from the main job after taxes and Social Security contributions, including overtime premia and bonuses) and deflating by regional consumer price indexes (base year 2002). For those paid per week, the survey transforms weekly earnings into monthly ones. Similar adjustments are used for workers paid by the day or every two weeks.

Human capital accumulation is analyzed by levels of education, consisting in five categories: no schooling or primary incomplete; primary complete; secondary; upper secondary and higher or

tertiary. Table 1 provides the mean of log real hourly wage, schooling years, age and potential experience for workers in our sample. We can observe the real wages increased throughout the wage distribution during 1987-1994; from 1995 to 1996 (the period of peso crisis) decrease. And, the next years the real wage showed a slight upward trend in different points of the wage distribution. Urban areas in Mexico contain a larger proportion of people with higher level of education. From 1987 to 2008 there was a substantial increase in education level. The acceleration in schooling was the product of concerted efforts to increase the coverage of primary and secondary education[16]. Average years of schooling have increased from 8.76 years to 10.87 years it increased more than two years over the period. As shown in figures 1 and 2, we can observe a clear trend from 1987 to 2008 in schooling years but a different picture for real wage. Meanwhile, the potential experience for the workforce increased from 16.38 years in 1987 to 18.31 years in 2008 and age of the labor force over the period is 32.62 years on average.

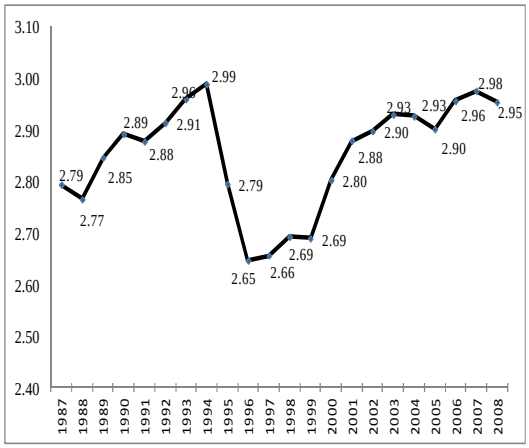
Table 1. Mean of the covariates, 1987-2008

Variable	Log real hourly wage	Years of education	Experience	Experience squared
1987	2.79	8.76	16.38	430.98
1988	2.77	8.95	16.17	421.63
1989	2.85	9.11	16.01	414.34
1990	2.89	9.19	15.86	408.11
1991	2.88	9.33	15.77	405.53
1992	2.91	9.52	15.85	406.62
1993	2.96	9.73	15.76	400.16
1994	2.99	9.82	15.85	398.28
1995	2.79	9.96	16.01	404.07
1996	2.65	10.00	16.12	407.02
1997	2.66	10.17	16.00	402.22
1998	2.69	10.08	16.19	406.77
1999	2.69	10.09	16.33	411.78
2000	2.80	10.19	16.55	421.51
2001	2.88	10.31	16.80	429.96
2002	2.90	10.43	17.12	441.36
2003	2.93	10.52	17.30	450.04
2004	2.93	10.63	17.32	451.69
2005	2.90	10.54	18.09	485.16
2006	2.96	10.61	18.12	488.12
2007	2.98	10.79	18.22	494.04
2008	2.95	10.87	18.31	498.77

Source: Own calculations. Results based on data panel ENEU-ENOE surveys from 1987 to 2008.

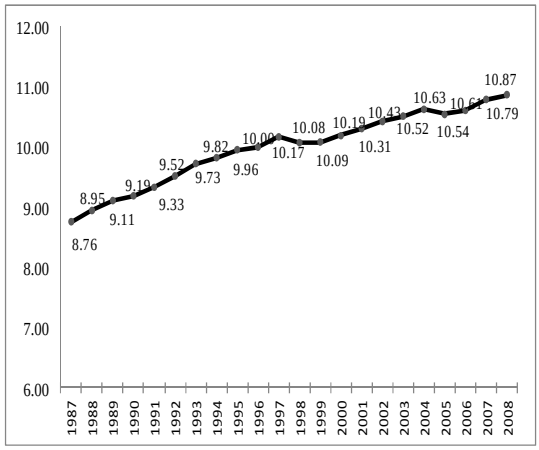
[16] The Mexican education system consist of 6 years of primary education and secondary education of 3 years of junior high. Primary education is free and mandatory. In 1992, 3 years of junior high were also made compulsory.

Figure 1. Real hourly wage (log) in Mexico, 1987-2008



Source: Own elaboration from ENEU-ENOE 1987-2008

Figure 2. Years of education in Mexico, 1987-2008



Source: Own elaboration from ENEU-ENOE 1987-2008

3.2 Quantile regression

In this section we disentangle the contribution of labor force characteristics and labor market prices in the dynamics of the Mexican wage structure. This literature goes back to the seminal contributions in 1973 by Oaxaca and Blinder, and it has seen great developments over the last three decades or in the non-parametric decomposition suggested by DiNardo et al. (1996). The most recent contribution in this literature is to consider a quantile regression setting, which explores the dynamics of the whole wage distribution. We make use of a methodology that has been recently developed by Melly (2005)[17], paper that use the same general idea as Machado-Mata (2005) and slightly different techniques in the implementation.

[17] As stressed by Autor et al. (2005), the Machado-Mata method for calculating counterfactual densities is closely related to the kernel reweighting approach proposed by DiNardo, Fortin and Lemieux (1996) and improved by Lemieux (2002, 2005). Further, the Machado-Mata approach can be easily extended to provide a uniform and consistent treatment of both overall inequality and residual inequality. On the contrary, alternative approaches apply a hybridized set of methods (OLS regressions, parametric probability models, and kernel reweighting) to separately derive counterfactuals for overall and residual inequality.

This methodology takes as starting point the quantile estimations from 1987 and 2008, using a mincerian (Mincer, 1974) standard specification:

$$\ln w_i^t = \alpha + X_i^t \beta^t(\theta) + u_i^t \qquad i = 1,\ldots, N \quad \text{and} \quad t = 1987\text{-}2008 \qquad (1)$$

Where lnw_i^t is the natural logarithm of the salary of the worker *i*, in the year *t*. X_i^t is the vector of exogenous variables more the constant α; β^t is a vector of parameters, θ is the quantile being analysed and u_i^t is an idiosyncratic error term. The vector X_i^t includes the characteristics of the individuals to: levels of education, variable that separates in five levels (no schooling or primary incomplete; primary complete; secondary; upper secondary and higher or tertiary); potential experience[18] and potential experience squared; gender (female and male*); marital status (married*, single and other); occupational controls (professionals and technicians, agricultural workers, senior directors and supervisors, operators and transport workers, salespersons and personal service workers and salary earners*); sectors of activity (Agriculture, Forestry, Fishing and Mining Sector, Industry and Manufacturing Sector* including Electricity, Gas Steam, Air conditioning and Water Supply; Construction, Trade; Transport, Storage and Communications Sector; Services sector including financial services)[19]; firm size (micro *, small medium and large)[20] , geographical controls for each of the 38 urban areas (Mexico City*), and time dummies are included taking 1987

[18] There is no information on actual working experience and, thus, in line with many studies we calculate potential experience as 'age–years in education minus 6' and is replaced by age as an explanatory variable.

[19] In November 1993, INEGI joined to the works that the United States and Canada were developing to construct a new classification of economic activities, based on the concept of the production function: the North American Industrial Classification System (NAICS). The new classification is used by Mexico, the United States and Canada for all the production and analysis of economic statistics, in substitution of the classifications previously used in the three countries. The *North American Industrial Classification System Mexico, 2002* Manual contains the classification's background, principles and criteria; the explanation of its structure; titles and descriptions of the categories; correspondence tables with SCIAN (in Spanish). SCIAN Mexico 2002 is available in INEGI's website, The structure can be compared with International Classifications of economic activities the **ISIC (**International Standard Industrial Classification of all Economic Activities) and the NACE (Classification of Economic Activities in the European Community).

[20] Small and Medium-sized Enterprises (SMEs) are classified according to the number of employees (10, 50, 250 and more than 250, respectively) into micro, small, medium, and large enterprises. World Bank (2010) and Economic Census, INEGI.

is the base year.[21] Following Koenker and Bassett (1978), we use quantile regressions to analyze the wage structure and the decomposition of inequality.

3.3 Decomposition of Changes in the Wages

In this subsection, we explain the strategy used to analyze the effects of covariates on wage inequality using the Melly (2005) decomposition. This decomposition analyzes whether changes in wage inequality are driven mainly by changes in characteristics, composition effect of the workforce and the variance of residuals. Taking as a starting point the results from quantile regressions, the implementation is straightforward. First, we estimate quantile regressions separately for each year for $\hat{q}$ with $\theta = 0.10, 0.25, 0.50, 0.75, 0.90$. Second, we keep the coefficients for each quantile and year.[22] Third, we calculate counterfactuals based on the endowment distribution for one year using the estimated coefficients for a different year. For example, to calculate the change in inequality in quantile θ caused by changes in quantities between two years. [23] Once having derived the quantile parameters $\beta(\theta)$, we estimate the marginal distribution of wages as function of both X and $\beta(\theta)$ and, next, we derive the counterfactual distribution of wages keeping the covariates at the 1987 level and coefficients at the 2008 level. Autor et al. (2005) and Melly (2005) defin e the coefficients component as a measure of between-group inequality. In particular, they taking the median as a measure of the central tendency of a distribution, it is possible to derive the wage equation for each year (1987 and 2008):

[21] The (*) represents the base category in each variable.
[22] Melly explains that assuming traditional restrictions of the quantile regression model, one can prove that $\hat{q}$ is a consistent and asymptotically normally distributed estimator of q_0. Given the difficulty in estimating the asymptotic variance, the statistical inference will be conducted with bootstrap procedures, a formal proof and the asymptotic variance can be found in Melly (2004). To estimate the θth quantile of y uses two steps procedures: i) Estimation of the whole quantile regression process $y = x\beta(\tau)$ and ii) Estimation of the θth quantile sample by weighting each observation by $(\tau_j - \tau_{j-1})$. The weights are not necessary if a regular grid of quantiles has been used.
[23] To estimate the θth quantile of y uses two steps procedures: 1) Estimation of the whole quantile regression process $y = x\beta(\tau)$ and 2) Estimation of the θth quantile sample by weighting each observation by $(\tau_j - \tau_{j-1})$. The weights are not necessary if a regular grid of quantiles has been used (Melly 2005).

$$\ln w_i^t = \alpha + X_i^t \beta^t(0.5) + u_i^t \qquad t = 1987\text{-}2008 \qquad (1.1)$$

where $\beta^t(0.5)$ is the coefficient vector of the median regression in the year t, which represents a measure of between group inequality. To disentangle the effect of coefficients (between-group inequality) from the effect of residuals (within-group inequality) it is important to note from (1.1) that the *θth* quantile of the residual distribution of u_i^t conditionally on *X* is consistently estimated by $\chi\left(\hat{\beta}^t(\theta) - \hat{\beta}^t(0.5)\right)$.[24] Accordingly, Melly (2005) defines the within component using the following vector of coefficients: $\hat{\beta}^{m2008,r1987}(\theta_j) = \left(\hat{\beta}^{2008}(0.5) + \hat{\beta}^{1987}(\theta_j) - \hat{\beta}^{1987}(0.5)\right)$, where the consistent estimate of the residual component given X, $\left(\hat{\beta}^{1987}(\theta) - \hat{\beta}^{1987}(0.5)\right)$, is added to the between component, $\hat{\beta}^{2008}(0.5)$. Using counterfactual distributions generated by applying different sets of covariates and coefficients, Melly (2005) computes how the variation over time of some quantile *q* of the wage distribution is attributable to covariates, coefficients, and residuals. In particular, Melly estimates the residual component as the difference, at the quantile *q*, of the two following distributions, $\hat{q}\left(\hat{\beta}^{2008}, \chi^{2008}\right)$ and $\hat{q}\left(\hat{\beta}^{m2008,r1987}, \chi^{2008}\right)$, where the X and the $\beta^t(\theta)$ are constant at the 2008 level whereas the residual inequality is the only one that changes over time.[25] Similarly, the difference between $\hat{q}\left(\hat{\beta}^{m2008,r1987}, \chi^{2008}\right)$ and $\hat{q}\left(\hat{\beta}^{1987}, \chi^{2008}\right)$ is due to changes in coefficients as characteristics and residual are kept at the 2008 level. Finally, the difference between $\hat{q}\left(\hat{\beta}^{1987}, \chi^{2008}\right)$ and $\hat{q}\left(\hat{\beta}^{1987}, \chi^{1987}\right)$ is due to changes in covariates.

[24] Note that it is possible to apply the conditional quantile process to (1.1), deriving:
$Q_\theta(\mathcal{U}|\mathcal{X}) = Q_\theta(w|\mathcal{X}) - \mathcal{X}\beta(0.5) = \mathcal{X}\beta(\theta) - \mathcal{X}\beta(0.5)$.

[25] The difference for each quantile q between the two distribution $\hat{q}\left(\hat{\beta}^{2008}, \chi^{2008}\right)$ and $\hat{q}\left(\hat{\beta}^{m2008,r1987}, \chi^{2008}\right)$ can be rewritten as $\{\hat{q}\left(\hat{\beta}^{2008}(0.5) + \hat{\beta}^{2008}(\theta_j) - \hat{\beta}^{2008}(0.5), \chi^{2008}\right) - \hat{q}\left(\hat{\beta}^{2008}(0.5) + \hat{\beta}^{1987}(\theta_j) - \hat{\beta}^{1987}(0.5), \chi^{2008}\right)\}$, from which it comes out clearly that the only component that changes over time is the residual one, in this way also providing an intuition for the choice of the definition of the within coefficient $\hat{\beta}^{m2008,r1987}$.

To sum up, adding and subtracting $q(\hat{\beta}^{1987}, \chi^{2008})$ and $q(\hat{\beta}^{m2008,r1987}, \chi^{2008})$ it is possible to decompose the variation over time of an estimated quantile of wage distribution into three components (residuals, coefficients and covariates), as follow: [26]

$$\hat{q}(\hat{\beta}^{2008}, \chi^{2008}) - (\hat{\beta}^{1987}, \chi^{1987}) =$$

$$\left(\hat{q}(\hat{\beta}^{2008}, \chi^{2008}) - \hat{q}(\hat{\beta}^{m2008,r1987}, \chi^{2008})\right) \quad \textit{Residuals}$$

$$+ \left(\hat{q}(\hat{\beta}^{m2008,r1987}, \chi^{2008}) - \hat{q}(\hat{\beta}^{1987}, \chi^{2008})\right) \quad \textit{Coefficients}$$

$$+ \left(\hat{q}(\hat{\beta}^{1987}, \chi^{2008}) - \hat{q}(\hat{\beta}^{1987}, \chi^{1987})\right) \quad \textit{Covariates}$$

(2)

Similarly it is also possible to decompose the variations of all the inequality indexes we are interested in, such as the ratios 90/10, 90/50 and 50/10.

4. Results

4.1 Quantile regressions results

To give a more detailed picture of the evolution of the structure of wage in urban areas in Mexico we estimate earnings functions, during the period under examination (1987-2008)[27], stress on labor market developments. Furthermore, we claim that the over education patterns derived in Table 2 and 3 reinforce this interpretation. According to the Lemieux's framework (2002, 2006), the increase of educated workers at the bottom of the job and wage distribution is associated to an increase in the dispersion of wages, which cannot be captured only with the analysis of education

[26] Note that the sum of the three components exactly amounts to the estimated variation over time of that given quantile. This property is not shared with other methodology previously adopted. Moreover, this decomposition is less restrictive than the JMP decomposition because the characteristics are allowed to influence the whole conditional distribution of *Y*.

[27] As mention above before the peso crisis and after the inequality had different trends related to the rapid changes in the structure of labor market, education, composition and location in urban areas of the labor force.

and experience. In this sense we try identifying the forces that contribute to review the changes in the structure wage apart from education variables aggregating other socio-demographic variables and characteristic of occupation, economic sector, firm size and location in urban areas of the labor force.

As first remark, it is worth pointing out that it is possible to estimates the coefficients for education and the covariates at all quantile of the distribution. Table 2 and 3 show the results consider over time of the OLS, quantile and interquantile models and in the Annex 2.1 and 2.2 show the results for each year by the three models. The information from Figure 3 to Figure 7 gives a summary the impact of each covariate upon wage inequality. In particular, we try to show the results of the returns of the covariates related to education levels, marital status, gender, potential experience, occupations, economic sector and the size firm gauged by OLS and quantile regressions at the 10^{th}, 25^{th}, 50^{th}, 75^{th} and 90^{th}. The complete results can be reviewed in the Annex 2.1.

Table 4 presents the returns to different levels of education and the other controls. The intercept term represents the log wage distribution of the base group –primary educated workers belonging married in marital status, in salary earners occupation, employed in the industry and manufacturing sector in micro firms residing in Mexico City and 1987 as base year. As expected, wages increase with the levels of education in particular secondary, upper secondary and higher or tertiary education increases the wage by a significant amount. However, to no schooling or primary incomplete workers the returns decrease. From 1987 to 2008 the non schooling workers were paid, at an average, approximately 14.6 % less in real terms that workers with primary level while the returns to secondary, upper secondary and higher or tertiary levels were 16.4%, 38.6% and 78.5% more in real terms that base group, respectively. The returns to different education levels are uniform across the distribution to the base group the returns to higher or tertiary education levels are larger at higher quantiles. In the results by year, we find that from 1987 to 1994 the returns clearly increased while for the following years the returns present slight differences and decreased. For instance, the contribution the returns to higher or tertiary education to within group inequality

strengthened between 1996 and 1997 in the four levels of education (as returns become more heterogeneous), as shown in Table A2.1.1-6 and Figure 3a-f.

The effects of demographic variables on wages: female workers, single and separated workers are paid significantly less over time and across the distribution, though the disadvantage is more at higher quantiles. In addition gender, there are few other demographic characteristics which play an important role in wage determination. The disadvantage faced by female workers decrease between 1991 and 1996 and also between 2002 and 2006. However, at the 75^{th} and 90^{th} quantiles, the effect is larger than the bottom part of the distribution. This goes against the perception that increased competitiveness reduces female workforce disadvantage (see Table A2.1.1-6 and Figure 4a-f).

The workers who reside in these cities are paid significantly less over time and across the distribution, though the disadvantage is more at bottom quantiles. In addition, these results suggest the heterogeneous relation between economic activity in the urban areas and the location of the labor force. For example, cities with important industrial activity as Monterrey or cities near the border as Ciudad Juárez, Tijuana, Matamoros and Nuevo Laredo show larger effects on the wage which play an important role in wage determination. These results are consistent with the findings on the studies of inequality in which the geographical variables are aggregated in regions, and how the impact of trade and financial liberalization in Mexico generated significant regional differences in relation to income inequality (see e,g. Hanson 2003 and Popli 2011). If we check the results across of the distribution in each year, regional variations continue to exert an upward pressure on inequality at the bottom and middle portions of the wage distribution, particularly. The changes exhibit irregular movements, with more substantial changes often concentrated in rather short lapses of time (see Table A2.1.1-6).

Some occupational categories dummies are statistically significant over time in all parts of the distribution (Table 2). For professional and technicians and senior directors and supervisors, there is a positive wage premium compared to the base category, while a negative wage premium is paid to sales and personal service, operators and transport and agricultural workers. From 1987 to 2008 the

professional and technicians were paid at an average approximately 35 % more in real terms that salary earners, while the returns to senior directors and supervisors were 23.2%, in the 75th and 90th the returns are larger. Figure 5a-f present the changes in the effects of the occupations over time and by quantiles. As it can be seen from this figure there is not much change in the returns of the professional and technicians and the trend is flatter than the others over the period.

Most of the economic sector dummies are statistically significant, but the impact is less than the other covariates. The positive wage premium compared to the industry and manufacturing sector is paid for sectors of services; transport, storage and communication; construction and agricultural, forestry, fishing and mining sectors while negative wage premium is paid by trade sector (see Table 2). These results are consistent with the findings of the studies countries in which industries that are capital-intensive or skill-intensive (or both) have higher wage premia (Dickens and Katz 1987; Hasan and Chen 2003). For most industries, there is no clear pattern in the industry wage premium across quantiles. Industries that pay a significant and negative wage premium tend to pay it over the entire distribution. There have also been few changes in industrial structure, as reflected in industry premium (see Table A2.1.1-6 and Figure 6a-f).

Regarding the effects of firm size on wages, small and medium and large firms are paid significantly more over time and across the distribution to micro firms. From 1987 to 2008 the workers employed in small firms were paid at an average approximately 11.5% more in real terms that workers employed in micro firms and the workers in medium and large firms 21.8%. Across the distribution and each year the positive effect of the returns to the small and the medium and large firms can be observed in Table A2.1.1-6 and Figure 7a-f, the contribution to within group inequality strengthened between 1995 and 1999. Table 5 shows the summary results of estimating interquantile regressions for 90/10, 90/50, 50/10, 75/25, 75/50 and 50/25 percentile ratios. Full results and estimations per year are shown in Annex 2.2. As we can see, from table 3, the returns to covariates are statistically significant in almost ost cases, indicating that the covariates introduced at the model have similar effects on wage dispersion to the ones described above. In particular, the

returns to education show a heterogeneous pattern across the conditional distribution of wages, a result confirmed by the magnitude of interquantile differences.[28] This result reinforces the idea that education gives an advantage to those located at the top of the distribution of wages, also enhancing the earnings potential of those located at the bottom.[29]

[28]To analyze the interquantile differences Buchinsky (1995) explains that the test of the interquantile differences is performed after an interquantile regression, which reestimates the model taking the difference between the coefficients across the wages distribution $\beta_{X\theta 1}$- $\beta_{X\theta 2} = 0$, where θ_1 and θ_2 are two distinct quantiles, say, 0.10 and 0.50 and the_k refer to regressor *X*.

[29] What would be consistent with the existence of a negative correlation between marginal costs and marginal benefitts of education across the abilities.

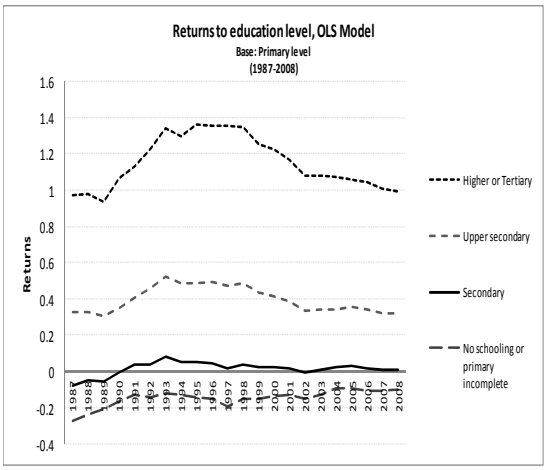
Table 2. OLS and Quantile regressions, México (1987-2008).

	OLS		10th quant.		25th quant.		50th quant.		75th quant.		90th quant.	
Gender (base: male)	-0.0788***	[0.00098]	-0.044***	[0.00144]	-0.062***	[0.00111]	-0.082***	[0.00106]	-0.106***	[0.00126]	-0.131***	[0.00179]
Marital status (base: married)												
Single	-0.115***	[0.00111]	-0.104***	[0.00162]	-0.102***	[0.00127]	-0.107***	[0.00122]	-0.112***	[0.00147]	-0.119***	[0.00209]
Other	-0.0726***	[0.00187]	-0.065***	[0.00269]	-0.069***	[0.00210]	-0.074***	[0.00202]	-0.077***	[0.00244]	-0.074***	[0.00347]
Education level (base: Primary)												
No schooling or primary incomplete	-0.146***	[0.00346]	-0.132***	[0.00516]	-0.129***	[0.00402]	-0.136***	[0.00384]	-0.157***	[0.00462]	-0.171***	[0.00658]
Secondary	0.164***	[0.00117]	0.119***	[0.00181]	0.133***	[0.00141]	0.152***	[0.00136]	0.176***	[0.00165]	0.208***	[0.00236]
Upper secondary	0.386***	[0.00145]	0.276***	[0.00216]	0.314***	[0.00166]	0.370***	[0.00157]	0.434***	[0.00188]	0.503***	[0.00271]
Higher or Tertiary	0.785***	[0.00204]	0.605***	[0.00284]	0.697***	[0.00214]	0.787***	[0.00198]	0.870***	[0.00239]	0.951***	[0.00349]
Occupation (base: Salary earners)												
Professionals and technicians	0.350***	[0.00172]	0.249***	[0.00233]	0.299***	[0.00178]	0.357***	[0.00167]	0.409***	[0.00202]	0.444***	[0.00296]
Agricultural workers	-0.291***	[0.00841]	-0.258***	[0.01009]	-0.264***	[0.00797]	-0.291***	[0.00786]	-0.329***	[0.00994]	-0.287***	[0.01490]
Senior directors and Supervisors	0.232***	[0.00173]	0.146***	[0.00248]	0.179***	[0.00192]	0.220***	[0.00183]	0.274***	[0.00221]	0.313***	[0.00316]
Operators and transport workers	-0.003	[0.00249]	-0.0131***	[0.00362]	0.003	[0.00286]	0.007**	[0.00276]	0.004	[0.00334]	0.013**	[0.00475]
Salespersons and personal service workers	-0.130***	[0.00120]	-0.186***	[0.00179]	-0.157***	[0.00139]	-0.131***	[0.00133]	-0.099***	[0.00160]	-0.064***	[0.00230]
Potential experience	0.0236***	[0.00013]	0.0190***	[0.00019]	0.021***	[0.00015]	0.023***	[0.00014]	0.025***	[0.00017]	0.026***	[0.00024]
Potential experience squared	-0.0004***	[2.69e-06]	-0.0003***	[3.80E-06]	-0.0003***	[2.95E-06]	-0.0003***	[2.82E-06]	-0.0004***	[3.40E-06]	-0.0003***	[4.82E-06]
Economic sector (base: Industry and manufacturing Sector (1))												
Agricultural, Forestry, Fishing and Mininig Sector	0.190***	[0.00527]	0.086***	[0.00629]	0.118***	[0.00497]	0.173***	[0.00487]	0.252***	[0.00613]	0.301***	[0.00916]
Construction	0.0915***	[0.00179]	0.126***	[0.00293]	0.116***	[0.00227]	0.099***	[0.00217]	0.082***	[0.00262]	0.063***	[0.00373]
Trade	-0.0289***	[0.00143]	-0.019***	[0.00220]	-0.021***	[0.00169]	-0.026***	[0.00161]	-0.031***	[0.00194]	-0.034***	[0.00278]
Transport, Storage and Comunications Sector	0.0798***	[0.00244]	0.003	[0.00331]	0.039***	[0.00261]	0.082***	[0.00252]	0.132***	[0.00306]	0.174***	[0.00436]
Services Sector (2)	0.0877***	[0.00128]	0.050***	[0.00183]	0.079***	[0.00143]	0.099***	[0.00137]	0.113***	[0.00167]	0.126***	[0.00246]
Firm size (base: micro)												
Small	0.115***	[0.00138]	0.137***	[0.001999]	0.111***	[0.00156]	0.098***	[0.00150]	0.098***	[0.00181]	0.107***	[0.00259]
Medium and Large	0.218***	[0.00113]	0.242***	[0.00170]	0.219***	[0.00132]	0.208***	[0.00123]	0.199***	[0.00146]	0.183***	[0.00207]
Constant	2.175***	[0.00382]	1.795***	[0.0056]	1.989***	[0.00439]	2.183***	[0.00425]	2.387***	[0.00519]	2.628***	[0.00739]
Source: Own calculations. Results based on data panel ENEU-ENOE surveys from 1987 to 2008.												
n = 1,372,978 and R-squared = 0.5												
Notes:												
(1) Including Electricity, Gas Steam, Air conditioning and Water Supply												
(2) Including Financial Services												
Including regional and temporal effects												
Robust standard errors in brackets												
*** p<0.01, ** p<0.05, * p<0.1												

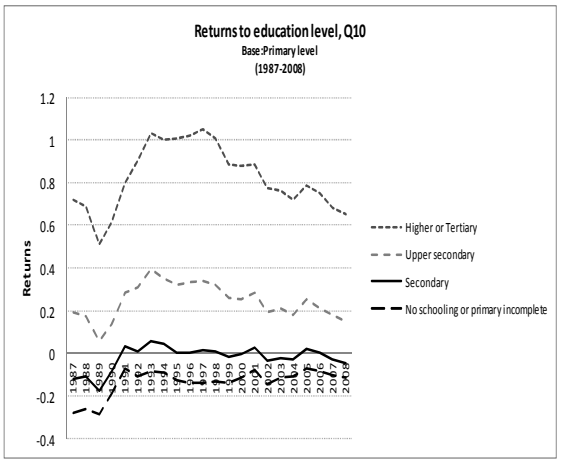
Figures 3 to 7 to summarize the trends of the returns to the different characteristics by quantiles: the education level (Fig.3a-f), marital status, gender and experience (Fig.4a-f), occupation (Fig. 5a-f), economic sector (Fig. 6a-f) and firm size (fig.7a-5f). From these figures, the following results should be highlighted: First, the level education increase between 1988 and 1993. Higher or tertiary, upper secondary and secondary levels earn more than the worker with primary level and worker with no schooling or primary incomplete level earn less than all categories (coefficients are negative), and that this educational gap increases as we move up through the wage distribution. This effect implies that the wage distribution for lower level of education is less dispersed than that for higher or tertiary and upper secondary levels, the negative sign associated with workers with no schooling or primary incomplete therefore indicates that a larger proportion of workers in that level of education contribute towards reduced wage inequality. Second, returns for unskilled and skilled workers rose in the early 1990s. Similar to trend in overall inequality, however, returns to skilled workers have fallen since 1995-1998, as shown in Table A2.1.1-6.

Figure 3. OLS and quantile regression coefficients to **education level**, (1987-2008).

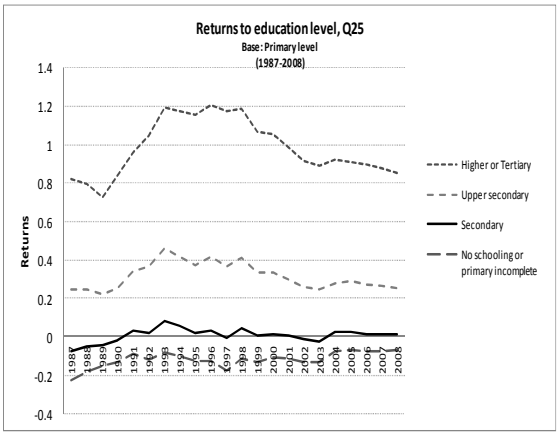
(a)



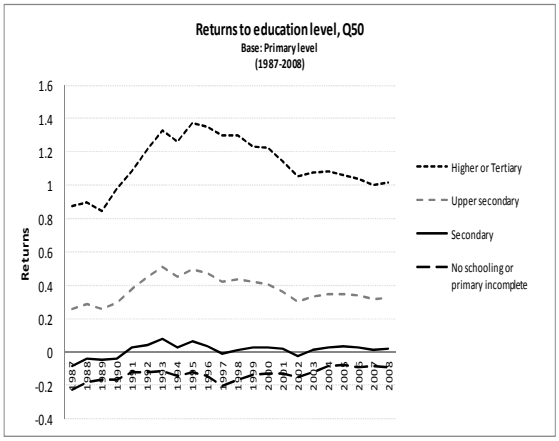
(b)



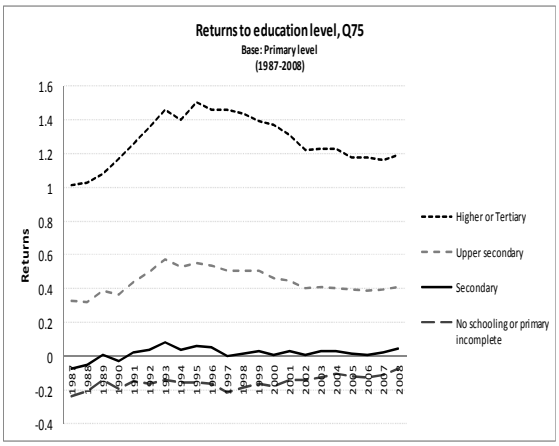
(c)



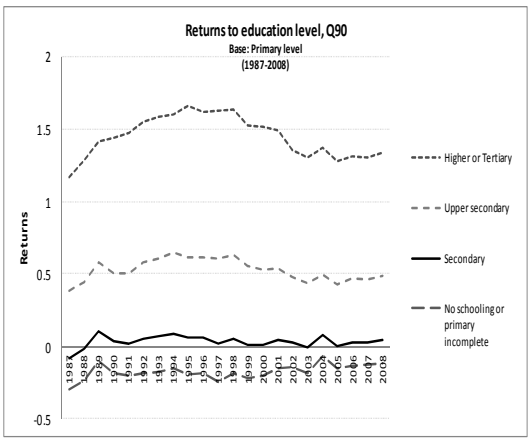
(d)



(e)



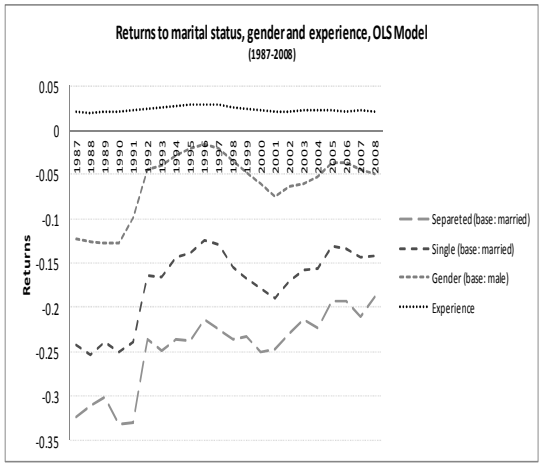
(f)



Source: Own elaboration from ENEU-ENOE 1987-2008.

Figure 4. OLS and quantile regression coefficients to the **marital status, gender and experience**, (1987-2008).

(a)



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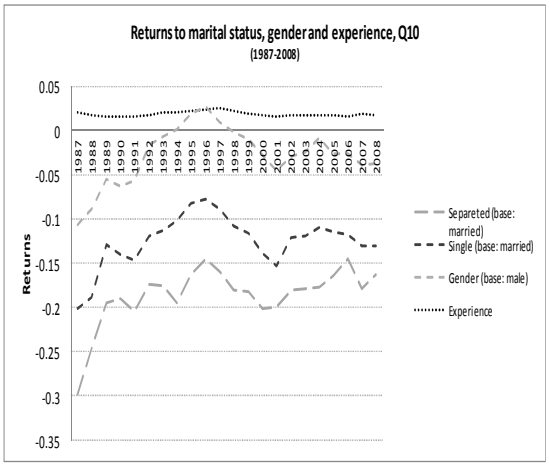
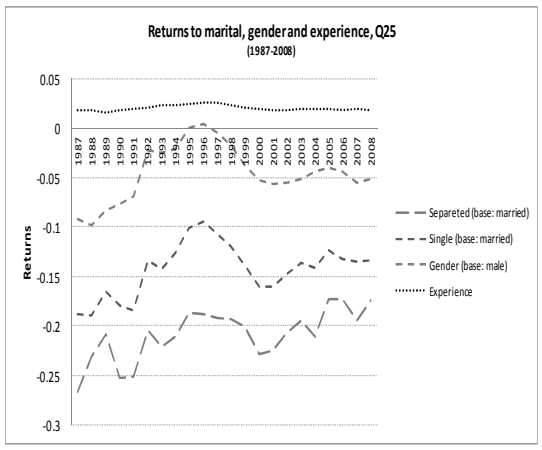


(c)



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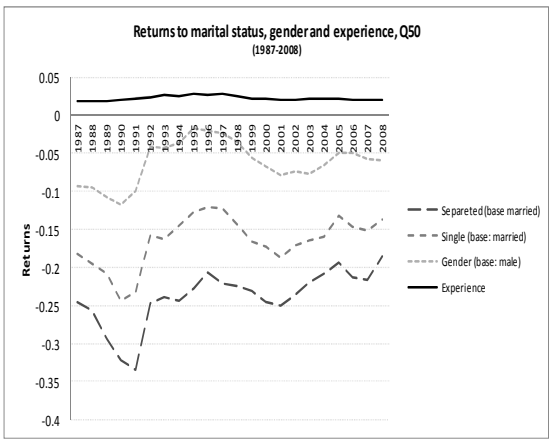

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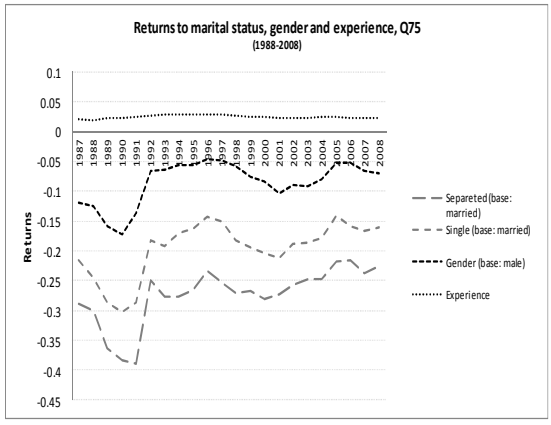
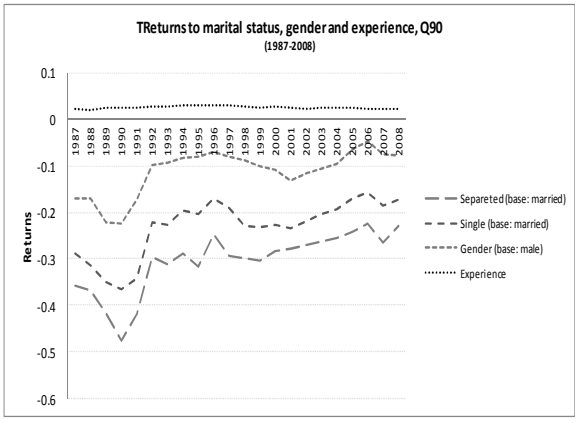


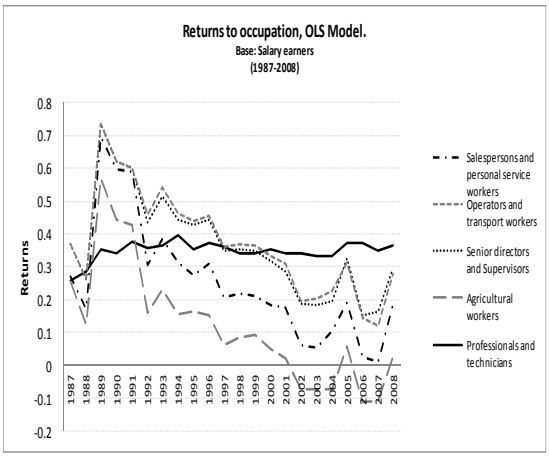
(f)



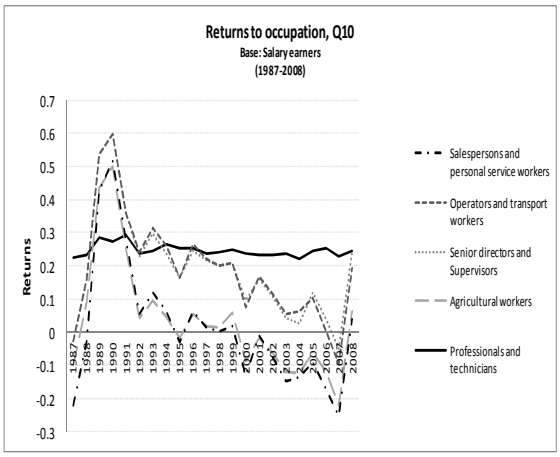
Source: Own elaboration from ENEU-ENOE 1987-2008.

Figure 5. OLS and quantile regression coefficients to **occupation**, (1987-2008).

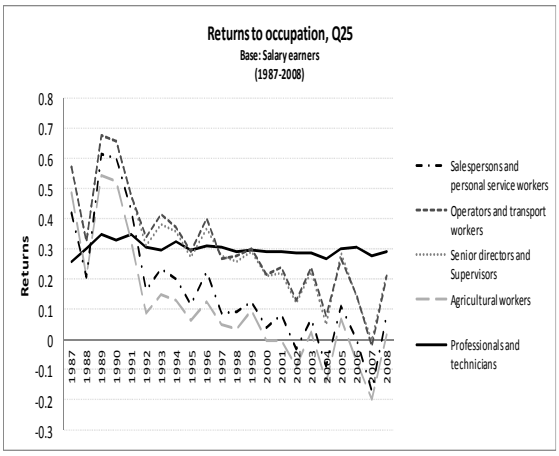
(a)



(b)



(c)



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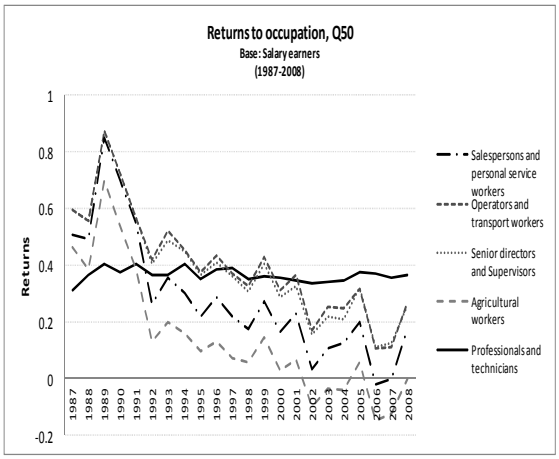
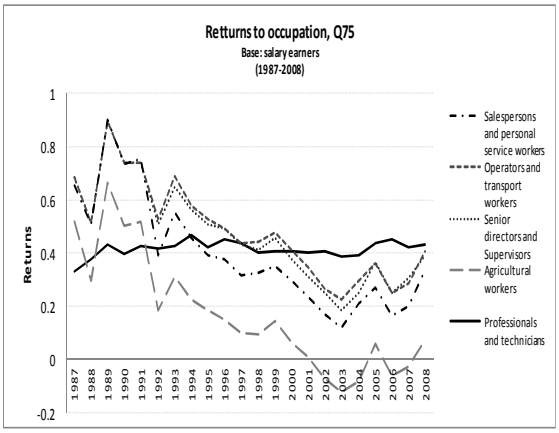
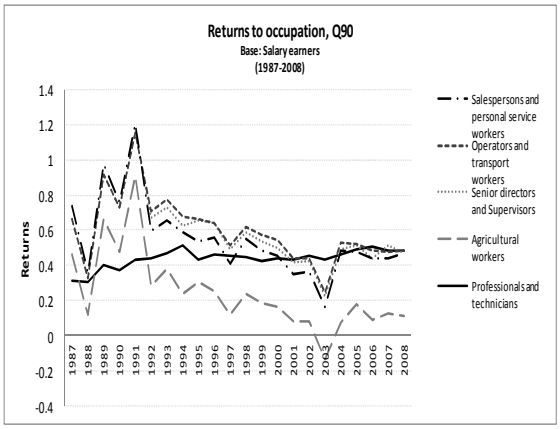


(e)



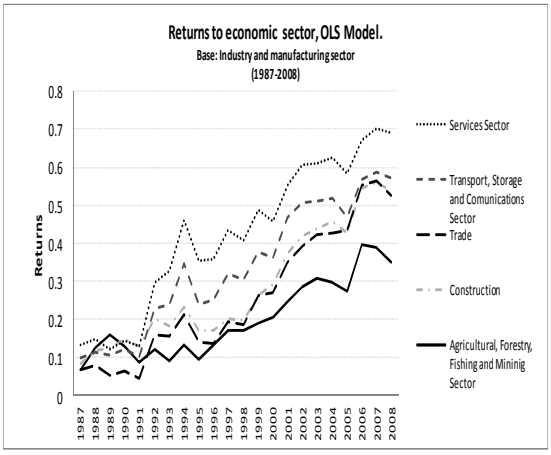
(f)



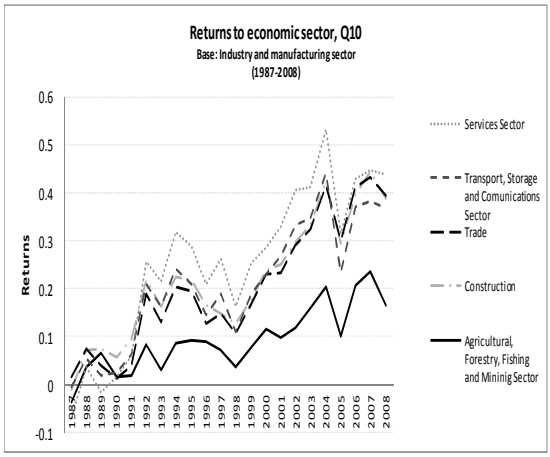
Source: Own elaboration from ENEU-ENOE 1987-2008.

Figure 6. OLS and quantile regression coefficients to **economic sector**, (1987-2008).

(a)



(b)



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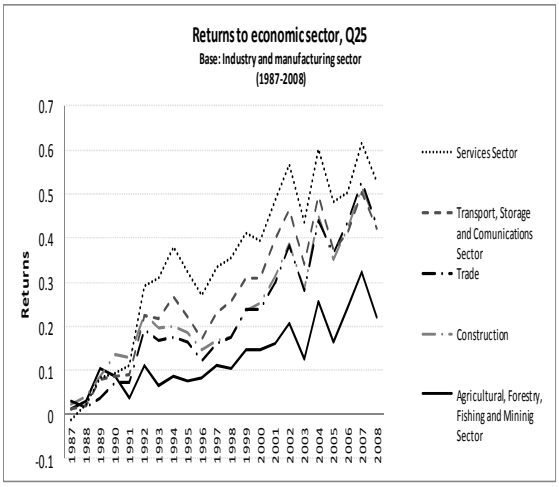

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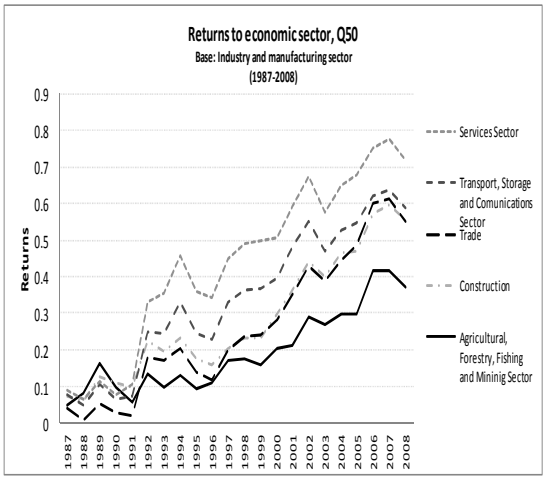

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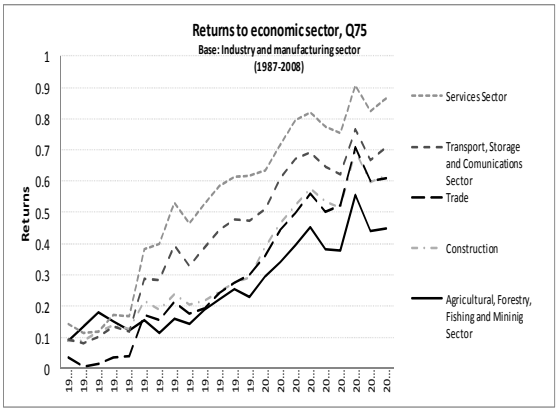

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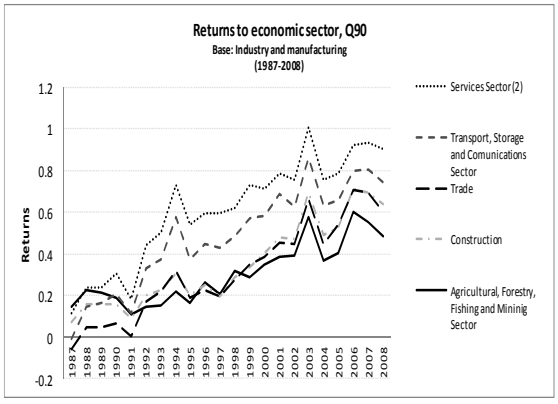
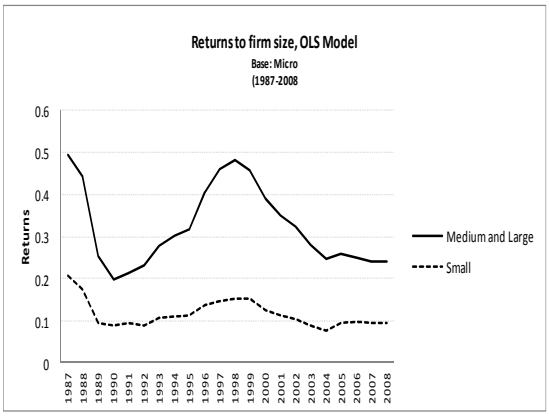


Source: Own elaboration from ENEU-ENOE 1987-2008.

Figure 7. OLS and quantile regression coefficients to **firm size**, (1987-2008).

(a)



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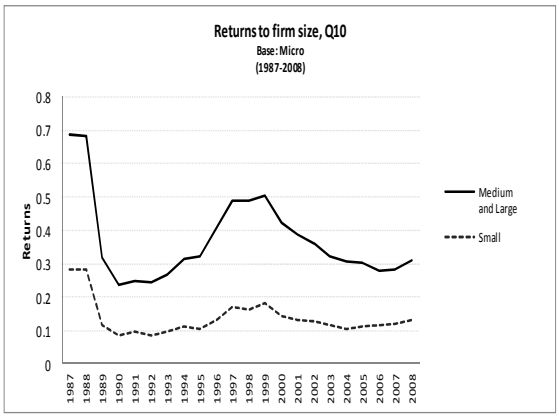

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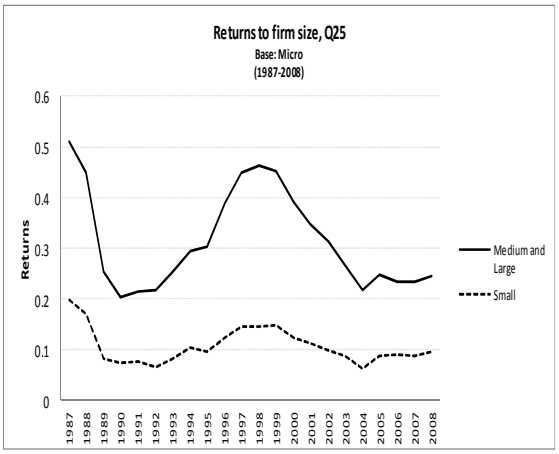

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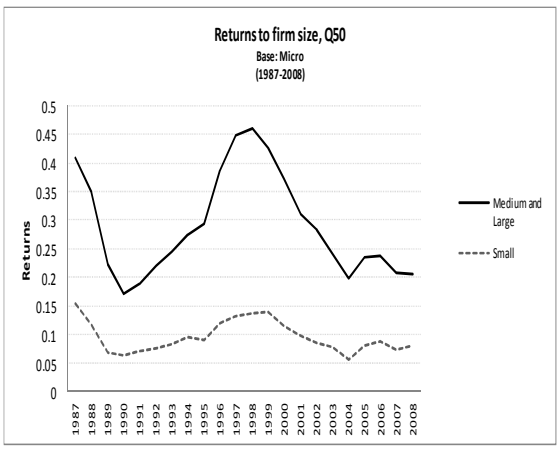

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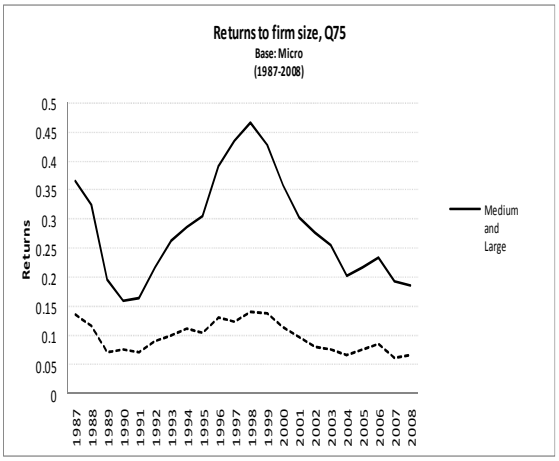

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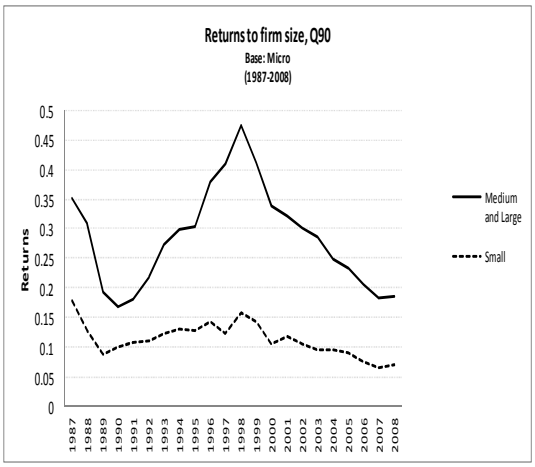


Source: Own elaboration from ENEU-ENOE 1987-2008.

Table 3. Interquantile regressions, México (1987-2008).

	90/10		90/50		50/10		75/25		75/50		50/25	
Gender (base: male)	-0.087***	[0.00006]	-0.049***	[0.00132]	-0.038***	[0.00133]	-0.043***	[0.00041]	-0.023***	[0.00132]	-0.020***	[0.00103]
Marital status (base: married)												
Single	-0.015***	[0.00199]	-0.013***	[0.00117]	-0.003***	[0.00046]	-0.009***	[0.00065]	-0.005***	[0.00069]	-0.004***	[0.00012]
Other	-0.009	[0.00710]	0.0002	[0.00243]	-0.010***	[0.00025]	-0.009***	[0.00148]	-0.002**	[0.00142]	-0.006***	[0.00169]
Education level (base: Primary)												
No schooling or primary incomplete	-0.039***	[0.00848]	-0.034***	[0.00201]	-0.005	[0.00836]	-0.029***	[0.00275]	-0.021**	[0.00632]	-0.008	[0.00481]
Secondary	0.089***	[0.00166]	0.056***	[0.00054]	0.033***	[0.00189]	0.043***	[0.00127]	0.024***	[0.00236]	0.019***	[0.00022]
Upper secondary	0.227***	[0.00089]	0.133***	[0.00024]	0.094***	[0.00007]	0.119***	[0.00475]	0.064***	[0.00164]	0.056***	[0.00161]
Higher or Tertiary	0.346***	[0.00666]	0.163***	[0.00422]	0.183***	[0.00585]	0.173***	[0.00544]	0.083***	[0.00432]	0.090***	[0.00267]
Occupation (base: Salary earners)												
Professionals and technicians	0.195***	[0.00358]	0.087***	[0.00318]	0.108***	[0.00279]	0.109***	[0.00414]	0.052***	[0.00255]	0.058***	[0.00182]
Agricultural workers	-0.029***	[0.03293]	0.005	[0.01571]	-0.033	[0.02387]	-0.065***	[0.00722]	-0.038***	[0.00126]	-0.028***	[0.00438]
Senior directors and Supervisors	0.168***	[0.00433]	0.093***	[0.00116]	0.074***	[0.00186]	0.094***	[0.00083]	0.054***	[0.00161]	0.040***	[0.00014]
Operators and transport workers	0.026***	[0.00118]	0.006**	[0.00192]	0.020**	[0.00580]	0.001	[0.00180]	-0.002	[0.00554]	0.003	[0.00725]
Salespersons and personal service workers	0.122***	[0.00202]	0.066***	[0.00277]	0.055***	[0.00209]	0.058***	[0.00195]	0.031***	[0.00031]	0.027***	[0.00160]
Potential experience	0.007***	[0.00023]	0.003***	[0.00012]	0.004***	[0.00007]	0.004***	[0.00020]	0.002***	[0.00018]	0.002***	[0.00005]
Potential experience squared	-0.000014**	[5.42E-06]	0.000005**	[2.30E-06]	-0.000019***	[1.83E-07]	-0.000012***	[3.84E-06]	-0.00001	[5.63E-06]	-0.000013***	[1.71E-07]
Economic sector (base: Industry and manufacturing Sector (1))												
Agricultural, Forestry, Fishing and Mininig Sector	0.215***	[0.01018]	0.128***	[0.01921]	0.087***	[0.00804]	0.133***	[0.01259]	0.079***	[0.00221]	0.055***	[0.00915]
Construction	-0.063***	[0.00376]	-0.036***	[0.00174]	-0.027***	[0.00003]	-0.034***	[0.00120]	-0.017***	[0.00015]	-0.017***	[0.00049]
Trade	-0.015**	[0.00482]	-0.009	[0.00761]	-0.007**	[0.00339]	-0.010***	[0.00022]	-0.005**	[0.00214]	-0.005***	[0.00074]
Transport, Storage and Comunications Sector	0.171***	[0.00313]	0.092***	[0.00463]	0.078***	[0.00467]	0.093***	[0.00226]	0.051***	[0.00061]	0.043***	[0.00097]
Services Sector (2)	0.076***	[0.00235]	0.027***	[0.00094]	0.049***	[0.00119]	0.034***	[0.00026]	0.014***	[0.00141]	0.019***	[0.00042]
Firm size (base: micro)												
Small	-0.030***	[0.00050]	0.009**	[0.00361]	-0.039***	[0.00233]	-0.013***	[0.00047]	-0.0002	[0.00027]	-0.013***	[0.00020]
Medium and Large	-0.059***	[0.00155]	-0.026***	[0.00179]	-0.033***	[0.00091]	-0.020***	[0.00020]	-0.009***	[0.00003]	-0.011***	[0.00172]
Constant	0.833***	[0.00199]	0.445***	[0.00034]	0.388***	[0.00613]	0.397***	[0.00532]	0.204***	[0.00162]	0.194***	[0.00487]

Source: Own calculations. Results based on data panel ENEU-ENOE surveys from 1987 to 2008.

Notes:

(1) Including Electricity, Gas Steam, Air conditioning and Water Supply

(2) Including Financial Services

Including regional and temporal effects

Robust standard errors in brackets

*** p<0.01, ** p<0.05, * p<0.1

4.2. Decomposition of changes in wage distribution

We apply the describe procedure to decompose the changes in the wage structure between 1987 and 2008 into changes attributable to covariates (individual workers' attributes), to coefficients (remuneration of these attributes), and to a residual component. Figure 8 plots the decomposition results at 999 different quantiles placed on the x-axis and Figure 9 shows the total of residuals effect in the decomposition. Table 4 shows the decomposition results. In particular, we report the estimated variation over time of some selected quantiles (10, 25, 50, 75, 90), and the related decomposition into the three components.[30] From the first row of Table 6 it can be noted that the upper tail of the distribution increases (the 75th and the 90th percentile), whereas the 10th, median and the 75th percentile decrease substantially over time.

As for the decomposition components, it emerges that the coefficients component (between) in the 75th and the 90th percentile is negative and increases in magnitude, ranging from -0.064 at 75th percentile to -0.144 at the 90th percentile. This implies that the decline in the price of human capital would have generated a shift to the left of the wage schedule, mainly concentrated in the right tail of the distribution, for constant covariates and residual components. This negative coefficients component is consistent with the dynamics of educational wage premia in Mexico. The educational wage premia decreased across the whole wage distribution over the period 1987–2008. Airola and Juhn (2005), López-Acevedo (2006), Campos-Vázquez (2008) and Popli (2011) show that educational wage premia decreased over the period 1987-1994, and across the whole wage distribution.[31]

As for the covariates component, it is positive at the 10th and 25th percentile and decreasing in magnitude from 0.148 at 10th percentile to 0.075 at the 25th percentile, whereas the median, the 75th and the 90th percentile is negative and increases substantially over time. The negative effect of

[30] It is worth noting that the estimated variations at the selected quantiles fit well the observed variations, as well as the inequality indexes. This provides additional evidence if favour of the quantile decomposition method.
[31] The results of Campos-Vázquez (2008) hold using two decomposition approach (Machado and Mata and Bound and Johnson decompositions), while Popli uses the Fields decomposition.

characteristics on the median indicates that if workers' attributes had been rewarded the same in 2008 as in 1987, wages should have fallen, not risen, in 2008. The residual contribution is negative at the lower tail of the distribution from the 10^{th} percentile to the medians, and becomes decidedly relevant at the upper tail of the distribution (in particular at 90th percentile).

These findings on the variations of selected quantiles of the wage distribution help to understand the dynamic relationship between the human capital attainments of the workforce and wage inequality (Autor *et al.*, 2005; Melly, 2005). Actually, the standard inequality indexes (90/10, 90/50, 50/10) can easily be derived from Table 4, computing the related ratios both for the estimated variations and for the three components. We observe that the upper tail (90/50) of the wage distribution increases, while a wage compression is observed in the lower tail, i.e., the 50/10 index decreases since wages of low skilled group (10^{th}) declined less than wages of individuals around the median wage level.

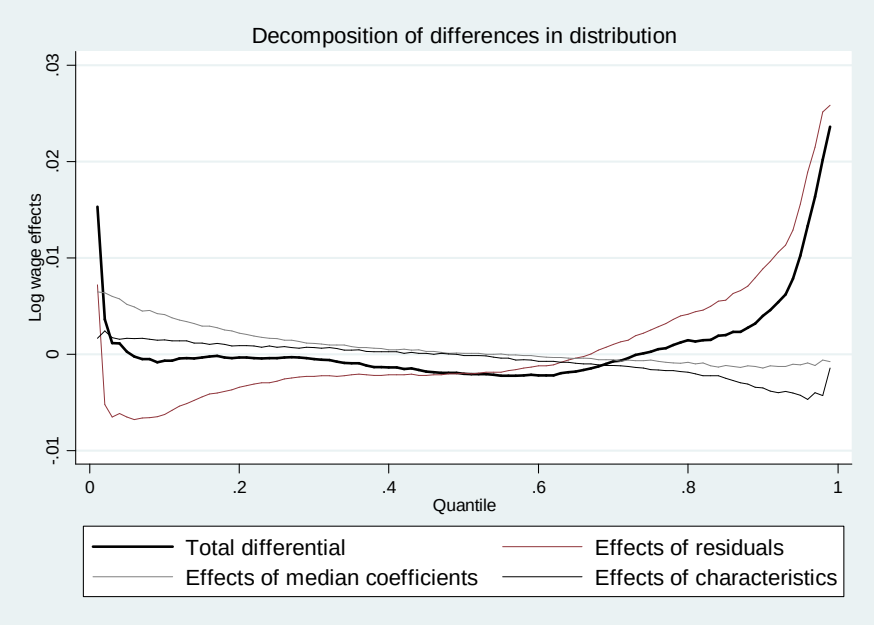
Considering the impact of the decomposition components on wage inequality, from Table 4 we show that the coefficients (between) effect is negative for the changes of three ratios, while 90/50 is less than 90/10 and 50/10 ratios . This negative price effect is reinforced by a relevant negative covariates component. As for within component, we observe a significant positive impact on the lower tail of the wage distribution and to a lesser extent in both the 90/10 and 90/50 inequality indexes.

The extent to which the positive residual component offset both the negative coefficients and covariates components depend on their relative magnitude across the wage distribution. Actually, the falling 50/10 ratio is mainly explained by the negative covariates and coefficients components, while the residuals inequality drives the increases in wage inequality at the top of the wage distribution. In particular, the 90/50 index increases is related to the residual component, while the stability of the 90/10 index is explained by negative coefficients and covariates effects that are counterbalanced by a positive residual component.

In order to provide an interpretation of the within component, we resort to 'skill price theory' (Juhn et al., 1993; Lemieux, 2002), which basically underlines two main effects. On the one hand, the positive (negative) changes in the coefficients component exert a positive (negative) impact on the residual component along the wage distribution, providing a measure for 'unmeasured price skills'. On the other hand, the residual component, i.e. to share of educated and experienced workers in the labor force. Our results reported in Table 4 suggest that up to the 75th percentile these two forces cancel out one another, involving a within component close to zero, while at the 90^{th} and 95^{th} percentile the positive effect related to the characteristics of workers seems to prevail to the negative effect induced by the coefficients component. In terms of wage inequality, this implies that the within inequality plays an important role in the upper tail of the distribution, as already stressed.

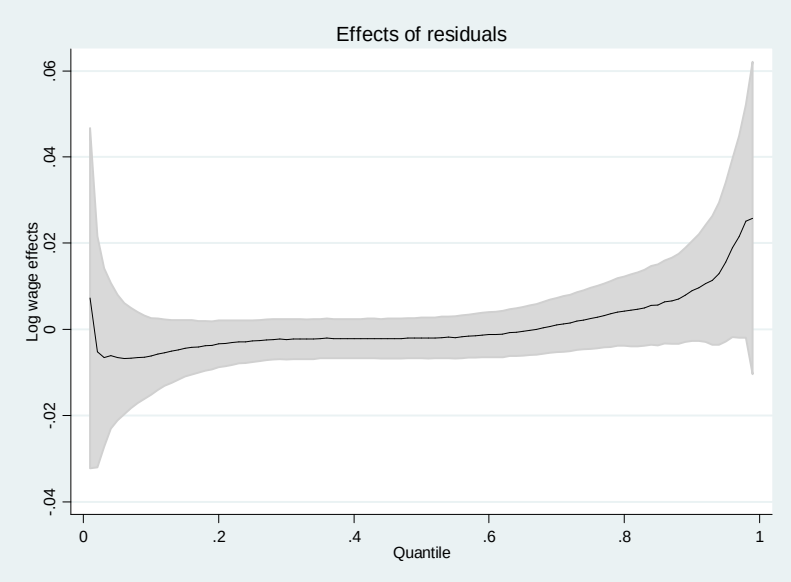
To sum up, the picture emerging from these decomposition exercises could be explained by the fact that labor demand might have increased less than the labor supply: in 2008 individuals employed in the labor market were more educated than those in 1987 but received lower wages for the same level of education. In other words, this evidence suggests that in Mexico we do not observe the standard features related to a skill-biased change, usually defined as an increase in the relative demand for skilled workers exceeding the increase in supply. This also means that in Mexico the choice of schooling could have been crowded out by the contents of the productive process.

Figure 8. Decompositions of differences in distribution using quantile regression (1987-2008)



Source: Own elaboration from ENEU-ENOE 1987-2008.

Figure 9. Total Residual effects of decomposition in distribution using quantile regression (19872008)



Source: Own elaboration from ENEU-ENOE 1987-2008.

Table 4. Quantile and inequality decomposition in the contributions related to covariates, coefficients (between) and residuals (within) in Mexico, 1987-2008.

1987-2008	10th quant.	(%)	25th quant.	(%)	Median	(%)	75th quant.	(%)	90th quant.	(%)	90/10	(%)	50/10	(%)	90/50	(%)
Total estimated variation	-0.066	1.0	-0.040	1.0	-0.202	1.0	0.027	1.0	0.397	1.0	0.463	1.0	-0.136	1.0	0.599	1.0
	(0.0065)		(0.0043)		(0.0045)		(0.0063)		(0.0088)							
Covariates contribution	0.148	-2.2	0.075	-1.9	-0.013	0.1	-0.162	-6.0	-0.348	-0.9	-0.495	-1.1	-0.160	1.2	-0.335	-0.6
	(0.0026)		(0.0024)		(0.0028)		(0.0041)		(0.0053)							
Coefficients contribution (between)	0.411	-6.2	0.161	-4.0	0.011	-0.1	-0.064	-2.4	-0.144	-0.4	-0.556	-1.2	-0.401	2.9	-0.155	-0.3
	(0.0050)		(0.0041)		(0.0041)		(0.0052)		(0.0079)							
Residual contribution (within)	-0.625	9.5	-0.276	6.9	-0.200	1.0	0.252	9.4	0.889	2.2	1.514	3.3	0.425	-3.1	1.089	1.8
	(0.0045)		(0.0025)		(0.0024)		(0.0036)		(0.0059)							
Source: Own calculations. Results based on data panel ENEU-ENOE surveys from 1987 to 2008.																
Note: the results have been multiplied by 100. Bootstrap standars errors with 100 replications in parentheses.																

5. Concluding remarks

In this paper, we investigated the relation between wage structure, inequality and skill-biased change for the Mexican case. Mexico is an outlier in the literature concerning the relationship between the changes over time of wage inequality and schooling premia distribution.

Moreover, we propose a method to decompose the changes in the wage distribution over a period of time into several factors contributing to those changes. Using a quantile decomposition methodology proposed by Melly (2005) in which uses a semiparametric estimator of distribution functions in the presence of covariates. The conditional wage distribution is estimated by quantile regression. Then, the conditional distribution is integrated over the range of the covariates to obtain estimates of the unconditional distribution. Counterfactual distributions can be estimated, allowing the decomposition of changes in distribution into three factors: changes in regression coefficients, changes in the distribution of covariates and residuals changes. We have applied this methodology to Mexico urban data for the period 1987–2008, a period during which earnings inequality show

different trends. The increase of wage inequality between 1987 and 1994. And as opposed to many developed countries, wage inequality in Mexico has been falling for the period after 1994.

Our estimates suggest that changes both in individuals' attributes and in the returns to these attributes contributed in different direction to the observed increase or decrease in wage inequality over time. Besides the contributions of both changes are variable in magnitude as per the different portions of the wage distribution are considered. The arguments put forward concerning the importance of that rising education leads to lesser wage inequality. Our analysis indicates that, contrary to this, that in Mexico increases in educational levels do not necessarily translate into a more equal wage distribution.

Even though the levels of educational enlarged very rapidly and educational inequality is the variable that accounts for by far the largest share of wage inequality in Mexico. There can be substantial heterogeneity among workers of each type of level education.

The marginal contribution of education to the explanation of inequality in Mexico is almost equal to the joint contribution of other relevant variables such as occupation, economic sector, firm size and urban areas. It is worth pointing out that the difference between the marginal contributions has been increasing over time, indicating that, as the economy progresses, education becomes even more important in determining the choices of sectors, occupations and firm size. Besides the contribution of relevant variables to changes in inequality for different intervals of time are related to changes in the covariates, coefficients (between effect) and residuals (within effect) in urban areas.

In general way, among quantiles the returns of education are positive in workers with secondary, upper secondary and higher or tertiary levels of education and in the category at below primary school level are negative. Moreover, the education wages profile indicated by the coefficients of the education dummies, has become steeper over time. In Figure 1 we show differences in the returns of education in different points of the distribution. The gap among the return to levels of education has increased, with most of the increased gap coming from a decline in

the returns to lower skill groups. And third, the evidence on educational dynamics in Mexico is mixed. On the one hand there was a modest reduction in the gap between the top and the bottom quintiles of workers. Average schooling improved somewhat, but the inequality of the distribution of education deteriorated, whereas the wage profile, which is related to the returns to schooling, became much steeper. This means that there was a shift in demand toward highly skilled labor that was not met by an increase in supply.

Even though, the returns to education in Mexico from 1987 to 1997 increase for higher levels of education and in the upper tail of the conditional wages distribution, there was a reversal to this trend after 1997, especially for the upper secondary and tertiary education. This offsetting the secular tendency for rising relative demand for skills (see de Ferranti et al., 2004). Alternatively, it may reflect a cyclical fall in education premia in times of recession.

The results suggest that the wages inequality evolution is not the result of changes in the distribution of education, whereas the wage profile, which is related to returns to schooling, is leading force in the explanation of inequality in Mexico. There may be multiple reasons for this situation: the education system, the minimum wage, the demography of the firms could all play a role. In light of this evidence, we analyzed the structure and evolution of the rates of returns to education and other controls that are important in the structure wage.[32]

In sum, the evidence points up to significant differences in terms of the characteristics of workers at different points of the distribution and transient effects by years. Educational levels gender, experience, occupation, economic sector, firm size and urban areas are important factors that affected the wage distribution over time. The increase in wage inequality between 1987 and 2008, especially at the bottom of the distribution, can be explained by a declining real wage. Inequality differs not only among these different groups but also within groups of workers.

[32] Hanson and Harison (1995) examine the impact of Mexican trade reform on the structure of wages using information at the firm level and the relation with the relative use of skilled labor, they conclude that the wage gap was associates with changes within industries and firms, which cannot be explained by the Stolper-Samuelson-Type effect. While López-Acevedo (2006), found the the increase in wage inequality was due to other factors this is part to aggregate other controls in particular with the idea that to access to market is important for the location of industry.

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