HUMAN CAPITAL AND WAGES IN TWO LEADING INDUSTRIES OF TUNISIA: EVIDENCE FROM MATCHED WORKER-FIRM DATA*

Christophe Muller and Christophe Nordman**

WP-AD 2005-07

Corresponding author: C. Muller. Universidad de Alicante, Departamento de Fundamentos del Análisis Económico, Campus de San Vicente, 03080 Alicante (Spain). E-mail: cmuller@merlin.fae.ua.es.

Editor: Instituto Valenciano de Investigaciones Económicas, S.A.
Primera Edición Febrero 2005
Depósito Legal: V-996-2005

IVIE working papers offer in advance the results of economic research under way in order to encourage a discussion process before sending them to scientific journals for their final publication.

---

* This paper has been supported by the ESRC under the grant no. R000230326. Christophe Muller is also grateful for the financial support by Spanish Ministry of Sciences and Technology, Project No. BEC2002-0309, and by the Instituto Valenciano de Investigaciones Economicas. Christophe Nordman gratefully acknowledges financial support from the Pôle-Développement of TEAM (Université de Paris I Panthéon-Sorbonne and CNRS) to carry out the survey in Tunisia. We have benefited from valuable comments from participants in a seminar at DIAL in Paris, in the Third Spring University of Mediterranean Economies in Ifrane, in the CLS Conference on "Labour Market Models and Matched Employer-Employee Data" in Sonderbörg, particularly from F. Kramarz, and in the Applied Econometrics Association (AEA) Conference on "Econometrics of Labour Demand" in Mons. Usual disclaimers apply.

** C. Muller: Universidad de Alicante. C. Nordman: Institut de Recherche pour le Développement (IRD)-DIAL.

HUMAN CAPITAL AND WAGES IN TWO LEADING INDUSTRIES OF TUNISIA: EVIDENCE FROM MATCHED WORKER-FIRM DATA

Christophe Muller and Christophe Nordman

ABSTRACT

From Tunisian matched worker-firm data in 1999, we study the returns to human capital for workers observed in two leading manufacturing sectors. Workers in the mechanical and electrical industries (IMMEE) benefit from higher returns to human capital than their counterparts in the Textile-clothing industry. In the IMMEE firms, low wage workers experience greater returns to labour market experience than high wage workers. The wage premium for on-the-job training is substantial for both sectors. However, taking into account whether formal training is still ongoing at the time of the survey, our results clearly indicate that workers bear heavy costs for their training. Our analysis shows that on-the-job training (OJT) and education can be efficient channels of policies aiming at raising earnings for low wages as well as high wages workers. However, careful consideration of the industrial sector should accompany these policies since specific impact of education, experience, OJT are found in the studied sectors.

Keywords: wage, returns to human capital, matched worker-firm data, quantile regressions, Tunisia.

JEL Classification: J24, J31, O12.

1. Introduction

In estimated individual wage equations, researchers typically include returns to human capital and skills through regressors describing schooling and the worker's experience[1]. However, the experience and the knowledge accumulated within the firm may differ from experience previously obtained off the firm. Consequently, some of the return to human capital for the worker may come from the characteristics of the firm or of the industry in which she works. Thus, a wage equation for a worker may incorporate personal skill characteristics and firm knowledge characteristics. As observed by Abowd and Kramarz (1999), the return to schooling decreases after controlling for firms' heterogeneity with fixed effects. Firm fixed effects and coefficients varying by industry can also be justified to account for selectivity or matching effects, economic rents correlated with human capital and other firm characteristics (Teal, 1996), or unemployment shocks affecting more some industries (Hoddinott, 1996). Meanwhile, vocational education and on-the-job training also affect the worker's human capital characteristics.

In this paper, we examine how the effects of human capital characteristics on individual wages arise and differ in two industrial sectors oriented toward exports in Tunisia, i.e. some of the most dynamic segments of the Tunisian economy. We base our econometric analysis on matched worker-firm Tunisian data that provides information both on employees and their firms. These data allow us to better understand inter-firm and inter-industry wage differentials for individuals with identical productive characteristics[2]. Inter-firm or inter-industry wage differentials are often explained by non-competitive wage determination[3]. Other approaches

[1] Mincer (1993); Card (1999).
[2] Krueger and Summers (1988), Abowd, Kramarz and Margolis (1999), Goux and Maurin (1999), Abowd, Kramarz, Margolis and Troske (2000). See Abowd and Kramarz (1999) for a survey.
[3] Katz (1986) reviews the efficiency wage theories, Lindbeck and Snower (1989) review the insider-outsider models.

stress more on compensating wages related to differences in jobs across industries (Murphy and Topel, 1987).

Our data is also relevant for dealing with poverty issues. The policies conducted by Tunisian Governments since the independence have led to a substantial reduction in poverty[4]. Hence, the poor are increasingly concentrated in peri-urban areas, particularly in Tunis[5], where our survey took place. As a consequence, we shall separate low wages and high wages in our analysis.

The rise in unemployment has been limited over the past decade despite a growth rate of the active population above three percent, substantial lay-offs in public and private firms, and the on-going rise in female labour market participation. However, the permanence of high unemployment (around 16 percent between 1994 and 1999) is a concern for the Tunisian authorities. Improving the qualifications of the Tunisian workforce should be part of the response to the high unemployment situation.

In view of these unemployment issues, the Tunisian government has recently taken steps to reform the labour market. The Labour Code was revised in 1994, and again in 1996, to make clear the conditions under which workers can be laid off. It also establishes guidelines for financial compensation. Moreover, with the elimination of the Multi-Fibre Arrangements scheduled to be completed by 2005 and the full implementation in 2007 of the Association Agreement with the EU, Tunisian firms will face fiercer competition both in their export markets and in the local market. The association agreement will have substantial social implications. Indeed, the EU represents about 75 percent of imports and 80 percent of exports. It is expected that the adverse shocks will be harsher for the small and medium firms and the unskilled workers. High skilled workers should be able to find better jobs. In contrast, less skilled workers may suffer economic shocks related to liberalisation and privatisation. Low-

[4] The World Bank (2001); UNDP Tunis (1994).
[5] Muller (2004).

wage workers may encounter employment difficulties and pressure to accept still lower wages. Improving sector productivity by raising human capital investment may help alleviate the adverse consequences of these shocks.

From a broader international perspective, in 1994, the mean wage of unskilled industrial workers was lower than in Mediterranean competitors including Morocco and Egypt (CNUCED/UNDP, 2001). However, for comparable skills, wages are still three times lower in China and India than in Tunisia. Therefore, developing the comparative labour advantages of Tunisia would require further investment in human capital in a context of growing globalisation of international exchanges.

To deal with this new economic context, the Tunisian government initiated in 1996 a vigorous modernisation programme of the productive sector in order to assist firms in adjusting to liberalisation (MANFORME, *Mise à Niveau de la Formation Professionnelle et de l'Emploi*). In particular, support was offered by the government for intra-firm human capital investment. The Tunisian authorities are notably stressing on vocational training. This corresponds to the two objectives of educating and preparing workers for a modern job market. Between 1996 and 1999, an investment value for 1161.7 million dinars (UNDP, 1994) has been spent on this programme. In March 2000, more than 1300 firms had taken part into this programme, representing 40 percent of total employment in firms of more than 20 employees.

The strategies pursued in the domain of vocational education and training should allow a significant progress of the skills of the Tunisian manpower. However, more efforts are deemed to be necessary as far as on-the-job training (OJT) is concerned, despite the mechanisms implemented in the programme MANFORME. Particularly, a stronger participation of the private sector is desirable (CNUCED/UNDP, 2001).

It is generally considered that investment in OJT is a key element of the strategy to deal with emerging tensions in the labour market while the economy moves closer to international

integration (The World Bank, 2001). Reforms of the education system will be instrumental to improve its responsiveness to emerging labour market demands. Recent labour studies reveal that job creation has been faster in urban areas, employment opportunities have been shifting toward higher skills, value added per worker is rising, and non-salaried jobs are increasing for men. The improvement in the education of the Tunisian workforce is accompanied by growth in labour productivity. Over 1989-97, value-added per worker increased by 17 percent, and by 34 percent in the Textile sector.

In 2002, the capacity of the vocational education and training system was of 60 000 individuals, which can be separated in 20 000 technical workers and 40 000 skilled workers (Belhareth and Hergli, 2000). This is consistent with the positive response of employers to vocational training. Thus, 90 percent of employers surveyed by Belhareth and Hergli (2000) stated to intend to provide some OJT.

Schooling opportunities or vocational training may help alleviating poverty but only if education returns are high for the low wage categories. If it is not the case, then education investment may lead to higher growth but also to higher inequality and have little impact on poverty.

Another question of interest in a context of economic reforms is: How does the minimum wage affect the wage distribution of low pay workers? Over 1989-97, wage changes were contained at the bottom of the pay scale in part because real minimum wages for agriculture and industry remain stable. Over this period, the industrial minimum wage decreased by only 1 percent. This is important because firms may react to the imposition of a legal minimum wage by reducing non-pecuniary attributes of jobs. One of this attribute is intra-firm OJT. Leighton and Mincer (1981) and Hashimoto (1982) suggest that, since human capital models predict workers will pay for part of any OJT through reductions in wages, a binding minimum wage

may reduce training opportunity. Consequently, OJT may be lower on jobs starting at the minimum wage, thereby worsening poverty.

The Textile-clothing (thereafter 'Textile') and the Mechanics, Metallurgical, Electrical and Electronics Industries (IMMEE) are the two main exporting industrial sectors in Tunisia. They differ by decisive workforce characteristics. Workers in textile firms are majority female, while most of the workers in IMMEE firms are male. In 1998, the period of our survey, the textile sector represented more than 50 percent of Tunisia's employment in transforming industries. It is an ancient industry that is largely dominated by the branch of clothing (83 percent of its firms) which is low capital intensive but highly unskilled labour intensive. In contrast, the IMMEE sector is more recent, especially its electronics branch, is relatively human capital intensive, and gathered more than 10 percent of Tunisia's industrial employment[6].

Moreover, in the Tunis area, where the essential of these two sectors' production is achieved and where industrial concentration is great and still increasing, IMMEE and textile firms both suffer severe international competition. For instance, the effects of international competition are faced by clothing and microelectronics units that are generally outsourcing firms. For these firms, geographical proximity to their European partners still constitutes a significant competitive advantage vis-à-vis their Asian competitors. However, given the much lower labour costs in some Asian countries, these Tunisian firms need to improve their use of human capital to achieve productivity progress and raise the quality of exported products. Indeed, data on mean labour productivity and skill structure (Belhareth and Hergli, 2000) shows that the IMMEE sector has a higher mean labour productivity than the textile sector (4.35 against 3.14). This may be explained by the higher proportion of high skill categories

[6] See Nordman (2002a) for further descriptive analysis of these two sectors.

(4.35 percent of engineers and executives for IMMEE against 3.14 percent, 6.24 percent of supervisory staff in IMMEE against 5.27 percent).

How does human capital affect Tunisian workers' wages for low and high wages in two industrial sectors oriented towards export? How do these two dynamic sectors differ as for the features of their wage distributions? What are the impact of on-the-job training and minimum wage on the wages in each sector? The aim of this paper is to study these questions by using unique matched worker-firm data. In Section 2, we present the data. We discuss estimation results for wage equations at different wage levels in Section 3. Finally, Section 4 concludes.

2. The Tunisian matched worker-firm data

The matched worker-firm data we use is discussed in details in Muller and Nordman (2004)[7]. In this data, we avail ourselves of information at worker level: individual characteristics, wages, educational investment, post-school training, total present experience in the labour market and occupation in the current firm. Moreover, the data include characteristics of the firms to which workers belong: organisational features, communication and training policies, innovation and competitive situations.

Table 1 in the Appendix presents the descriptive statistics of the surveyed firms. The four firms of each industrial sector are located in the Tunis area and belong to the formal sector. They are selected so as having no less than 50 employees, with vocation to export and capital ownership not entirely foreign. This firm sample corresponds to firms that typically suffer from shocks and policies we discussed above. The average size of the visited establishments is 130 employees (respectively, for the textile and IMMEE sectors, 178 and 84 employees).

[7] See Nordman (2002a, 2002b) and Destré and Nordman (2002) for the methodology of the Tunisian survey.

Our data confirm the common finding that IMMEE firms use more human capital than textile firms. Indeed, workers' mean education and mean labour market experience are higher in the former than in the latter (respectively, 11.25 versus 8.9 years for education; 6.7 versus 4.9 years for job tenure and 9.8 versus 8.2 years for total experience)[8]. Although detailed comments on the other firms' characteristics cannot be reported here for reasons of space, a few summary comments are in order: IMMEE firms provide OJT while textile firms do not; the former exhibit higher supervision and management rates and also report greater level of stimulated communication (for instance, through regular meetings, distributed technical notices, notice board, etc.). These statistics are in accordance with the fact that the IMMEE sector makes more use of skilled labour. Finally, the textile firms seem more subject to high levels of competition than the IMMEE firms. The former may therefore be more concerned by diminishing its labour costs.

Table 2 in the appendix provides descriptive statistics of the employees' socio-economic characteristics and wages in these firms. The 231 workers in the final sample we use were interviewed in February 1999. Workers in the textile firms are mostly female (86 percent) while they are mostly male in the IMMEE (93 percent). It appears that workers in the IMMEE are slightly more educated than their counterparts in the textile sector (10.6 versus 8.9 years of completed schooling)[9]. For the IMMEE sector, this level of education corresponds to the first year of high school. Moreover, in the textile firms 1.6 percent of the observed workers have never gone to school while there is no illiterate in the IMMEE firms. However, the proportions

[8] These firm characteristics are calculated using workers' sub-sample characteristics corrected by information collected using a questionnaire addressed to employers (that is, for most firms, the true mean education of employees is observed).

[9] In contrast, calculating the education variable from the age at the end of school (from which we deduct 6 years), the average number of schooling years is 13.7 for workers in the IMMEE and 12 years for their counterparts in the textile. Thus, accounting for unsuccessful years of education, we choose to use an education variable net from repeated classes. Consequently, our schooling variable includes an important qualitative aspect. See on this point Behrman and Birdsall (1983).

of employees having received a vocational diploma related to their current job are similar across sectors and amount to about 32 percent.

Not only IMMEE workers are more educated but they are also more experienced and trained since their average tenure amounts to 7.0 years versus 4.9 years for the workers in the textile sector. Formal training has been received for about 20 percent of the workers in the IMMEE firms but for very few individuals in the textile firms. 4 percent of the observed workers in the IMMEE are still continuing their training spells at the date of the interview. Finally, note that statistics about the characteristics of the occupations show that the IMMEE employees are more often attached to team work than employees in the textile (54 percent versus 21 percent), while the proportions of observed supervisors or executives in the firms' sub-samples are almost similar (about 19 percent).

The wage characteristics are also worth noting. The average monthly wage declared by textile employees is 351 US dollars[10], while the average monthly wage for IMMEE workers is 1.6 times the textile wage. This differential is consistent with the fact that in Tunisia the textile sector is the manufacturing industry with the lowest wage. Beyond differences in human capital endowments across sectors, the overwhelming proportion of females in the textile sample, for whom, ceteris paribus, wages may generally be lower than for males, might contribute to widening this rough sector wage differential[11].

Figures 1 to 3 in Appendix show the histograms of observed wages. The minimum wages (SMIG, *Salaire Minimum Interprofessionnel Garanti*) are indicated by vertical lines for 40 hours and 48 hours per week, since different minimum wages are used for the two categories. In 1999, the SMIG of employees working 40 hours per week amounted to 156.7 dinars while

[10] Overall, the average monthly wage corresponds to 1.8 times the monthly SMIG of 1997 for a regime of 48 hours per week (177.8 Tunisian Dinars, that is 125 US dollars in 2001). The declared monthly wages are those of January and February 1999.
[11] For gender issues on these data, one can refer to Nordman (2004).

that of 48 hour per week workers was 177.8 dinars[12]. Workers in the textile sector are all subject to 48 hour work per week while, in the IMMEE sector, it only concerns non-executive workers. Figure 1 shows that the workers' wages in the two sectors are concentrated around values slightly above the minimum wages, while heavy right tails account for a small number of very skilled workers. For the textile sector (Figure 2), wages are also very concentrated and often appear below the 48 hour per week minimum wage. As compared to Figure 2, the wage distribution in the IMMEE sector (Figure 3) has shift well above the minimum wages and presents a significant number of workers in the upper tail of the distribution. We are now ready to discuss the estimation results.

3. The Estimation Results

3.1 The model and the estimation method

In the Mincerian earnings function, the returns to human capital are given by the coefficients of schooling and labour market experience often accompanied by their squared values[13]. However, returns to human capital can vary across wage categories. For instance, high wage workers should not benefit from the same return to experience than low wage workers since the latter may have fewer incentives to make further on-the-job investment in human capital because they only deal with basic tasks. Alternatively, more educated individuals – generally with higher wages – may have greater incentive to invest in training because they learn more quickly. As a result, the shape of the relationship between the workers' wage level and their returns to education and work experience (former experience plus tenure in the

[12] That is, 110 and 125 US dollars of 2001.
[13] More flexible polynomial specifications have been tried but cannot be accurately estimated with these data.

incumbent firm) is unclear. To capture differentiated returns of education and experience between the rich and the poor, we construct two individual dummies indicating the workers' relative position in the sample in terms of hourly wage (first quartile and fourth quartile). These two dummies (QUARTILE1, QUARTILE4) are allowed to interact with the main three human capital variables in the wage equation: education, tenure and previous work experience. In our estimates, the reference category is then workers belonging to the middle of the wage distribution, that is, to the second and third quartiles[14].

The lack of suitable matched worker-firm data for the wage analysis has been deplored by a number of authors, such as Rosen (1986) and Willis (1986), as such data allows the structure of wages to be modelled while controlling for firm-specific effects. With our matched data, we can deal with the firm heterogeneity by introducing firm dummy variables into the wage equation. Naturally, it is possible that part of what could be interpreted as the firms' specific wage policy in the estimates (the coefficients on the dummy variables) is in fact a consequence of the worker selection by firms and vice versa. For example, very productive firms and workers may choose each other. In this paper, because of data limitations, we do not deal with this difficulty, and we assume that selectivity and sub-sampling effects can be neglected.

Since we have cross-sectional data, we cannot model unobserved individual heterogeneity in the way of Abowd, Kramarz and Margolis (1999). To temper the effects of unobserved individual heterogeneity which might bias the estimated coefficients, we add control variables to our OLS regressions and perform instrumented regressions (2SLS).

In the wage equations, we incorporate formal training received in the current firm (ongoing training and past training). In our pooled sample over both sectors, more educated

[14] Statistics specific to each wage quartile show that workers' characteristics differ according to wage level. Lower wage workers are less educated, trained and experienced. They are on average younger, mainly females and have suffered longer unemployment spells. These results suggest separate modelling of the wage rates at different wage levels.

workers generally receive more formal training: on average 12.2 years of schooling for workers having received formal training compared to 9.1 for the others. Together with the worker's sex, two other dummy variables are retained in the regressions[15]. One dummy variable controls for the worker's hierarchical position in the firm (executive or supervisor, which we denote 'executive' thereafter), while the other indicates whether the worker's wage is close to the minimum wage (SMIG, see definition in Table 2 in Appendix). Workers who are executive are expected to have higher earnings.

We do not limit our analysis to the OLS results or 2SLS estimations. Introducing two dummies for quartiles in the regressors creates endogeneity problems that may be imperfectly corrected with instrumental variable methods. A way to avoid this difficulty is by using quantile regressions. Quantile regression estimators have recently become popular estimation methods (Koenker and Bassett, 1978), which have been employed for wage analyses (Buchinsky, 1998, 2001). They allow the researcher to concentrate her attention on specific parts of the conditional distribution of the dependent variable. We use bootstrap confidence intervals for quantile regressions (Hahn, 1995). Let us now move on to the estimates.

3.2 The wage equation estimates

Tables 3 and 4 in Appendix present the regression estimates of the determinants of log hourly wages for workers in the textile and IMMEE sectors. The equality of the coefficients for separated wage functions for the textile and IMMEE is rejected (at the 1 percent level)[16]. The first two columns in Tables 1 and 2 correspond to OLS estimates without quartile dummies as regressors. The following two columns show the results obtained when the returns to human

[15] All the other socio-economic variables are dropped from the regressions for lack of significance and to preserve degrees of freedom given the limited sample sizes.
[16] The Fisher test statistics of the Chow test of equality of the coefficients for equation (1) in Tables 3 and 4 amounts to 5.12.

capital can vary at the bottom and at the top of the wage distribution through the inclusion of the two dummy variables for the first and fourth wage quartiles[17].

The wage equation which incorporates firm's fixed effects is characterised by better goodness-of-fit than the standard Mincerian wage function in the IMMEE sector. Fisher tests do not reject the fixed effect at 1 percent level. On the contrary, the firm dummies' coefficients are not significantly different from zero for the textile sector. As noticed by Abowd and Kramarz (1999), returns to schooling decrease after controlling for firms' heterogeneity with fixed effects. In OLS regressions, the marginal return to education is, respectively for the textile and IMMEE firms, 5.38 percent and almost 8 percent with the firm's fixed effects instead of 5.51 and 9.35 percent without the firm dummies. These drops in the return to education in Tunisia are in the scope of usual results (Abowd and Kramarz, 1999)[18]. To our knowledge, no comparable estimates exist on Tunisia[19].

The return to education is significantly higher in the IMMEE firms than in the textile firms. High returns to education in IMMEE in 1999 may be explained by stylized facts of the labour market. Since IMMEE firms make more use of human capital than textile firms, it is not surprising to find greater rewards for schooling in the former sector than in the latter. Secondly, textile firms may be more concerned by raising their competitive advantage vis-à-vis their Asian competitors in diminishing labour costs than IMMEE firms for whom activity is more turned towards high added value products, in particular in the electronics branch. This may affect the way employers reward qualifications in the Textile as compared to the IMMEE. Finally, some of the education effect may be caused by selection. Firm dummies may help

[17] We also tested interactions of these dummies with the quadratic terms of the experience variables to take account of possible differentiated decreasing returns to experience across wage quartiles. However, since the results were little significant, we choose to exclude these interactions to preserve our degrees of freedom.

[18] With comparable equations using French data for these two sectors (1992 ECMOSS survey), we find a drop from 5.43 to 5.23 percent. See Destré and Nordman (2002) for fixed effect wage regressions using French data on these two sectors.

[19] Except Muller and Nordman (2004) who estimate wage equations grouping both sectors. See Psacharopoulos (1985, 1994, 2002) for surveys reporting the returns to education in numerous countries.

control for the selection effects, but other individual and household characteristics are missing which does not allow us to be fully protected against a selectivity bias.

Columns (3), (4) and (5) elicit returns to human capital that are often significantly different across wage quartiles, without and with adding the firm's fixed effect, respectively. Table 5 summarises the main results of all these estimators by computing the returns to education, job tenure and previous experience for the bottom (first quartile), the middle and the top (fourth quartile) of the wage distribution. In the textile sector, looking at OLS estimates, we find that the low wage workers (first quartile) have no significant returns to both education and previous experience while the high wage workers exhibit substantial returns to education (6.6 percent) and experience (3.2 percent). In contrast, the returns to tenure follow a U curve along the wage distribution, i.e. low wage and high wage workers benefit from greater rewards for job seniority (about 3.5 percent) than workers in the second and third quartiles. This is consistent with results found from quantile regression estimates in industrial countries, where returns to schooling are higher for the more skilled individuals (Martins and Pereira, 2004).

In the IMMEE sector, the picture is somewhat different. The returns to human capital for the low wage workers are significantly different from zero and higher than that of their counterparts in the textile firms. For instance, the return to education in the first quartile is not significantly different from that estimated for workers in the middle of the wage distribution (about 3 percent). However, high wage workers display significantly greater returns to schooling (8.2 percent). As for tenure, its return is higher for the low wage workers while it is not significantly different from zero for middle and high wage workers at the 10 percent level. The results for experience emphasise the same U curve that describes its return as a function of the wage levels (respectively, 4.1, 1.8 and 3.7 percent).

We attempt to control for the possible endogeneity of the education variable by using two-stage least square regression (2SLS) whose estimates are shown in column (5). Moreover,

the introduction of the two dummies for wage quartiles creates an additional source of endogeneity that must be dealt with. The set of instrument for both education and the wage quartiles is reported at the bottom of Tables 3 and 4[20]. An important instrument for the worker's education variable is the education level of the worker's father[21]. For education, the main results remain unchanged (Table 5). However, the returns to human capital are refined: the average return to education increases from 2 percent (OLS) to 3 percent (2SLS) for textile workers, while it is stable at about 4 percent for IMMEE workers[22]. In the textile sector, this return is enhanced for the high wage workers while, in the IMMEE sector, the reward for education declines for these workers. Therefore, 2SLS estimates narrow the gap in the return to education across sectors. While the return to experience become not significantly different from zero for the textile workers, IMMEE workers continue benefiting from greater returns to tenure and experience than their counterparts in textile firms. Meanwhile, in the IMMEE sector and from both OLS and 2SLS estimates, the low wage workers seem better off than high wage workers as for their returns to labour market experience. In contrast, in the Textile, the high wages have greater rewards for their human capital endowments.

We also investigate whether returns to human capital differ across the wage distribution by using quantile regressions for quantiles 0.25, 0.50 and 0.75. These estimates are shown in columns (6), (7) and (8) of Tables 3 and 4. The results confirm the presence of gaps across the quartiles in the returns to education, tenure and previous experience (Table 5), though the coefficients on experience and tenure are often insignificant, especially in the Textile. However, some of our previous results are sustained: firstly, there is indeed a higher return to

[20] The values of the F-statistics and R^2 in instrumental equations ensure that we are not in the weak instrument case (Abadie et al., 2002). We attempted to instrument the experience variable as well, although this did not yield any good result since we lack additional instrumental variables to perform it in good conditions.

[21] This instrument, popular when using developing country data, may capture various genetic and environment influences (Sahn and Alderman, 1988).

[22] The increase is consistent with the effects of instrumental variables in some empirical works. For example, Card (1999) finds that for U.S. data, 2SLS estimates on returns to education are often 15 percent higher than OLS estimates.

education for the richest workers in textile firms. Secondly, in the IMMEE sector, workers at the bottom of the conditional wage distribution benefit from important returns to human capital and there is a persistence of a U curve describing the return to experience along the distribution. This last finding is also true in the textile firms (for tenure and experience) but the coefficients on the experience variables are not statistically significant at the usual confidence interval (most likely, as a result of the small sample size). This is in contrast to different findings from Portugal in Machado and Mata (2001), where all aspects of human capital are relatively more valued only for high paying jobs. However, the last quartile corresponds to the highest returns to education in the Textile.

Let us now look at the other estimated coefficients. Completed formal training plays an important role in explaining wage differentials (in both sectors, its coefficient is always significant at a 5 percent level and positive). This is consistent with theories that argue that wage differentials should reflect differences in training investment. The wage premium for any completed training amounts to about 55 percent in textile firms and to about 17 percent for IMMEE firms. This is a quite considerable training effect[23]. Our regressions for IMMEE take into account whether formal training is still ongoing at the time of the survey (note that there is no individual with positive value on this variable in our textile firms). The negative coefficient on the variable taking into account ongoing training clearly indicates that workers bear the full costs of their formal training in accepting a lower wage during their training period (also investigated with US data in Lynch, 1992; Barron et al., 1998; Parent, 1999). Indeed, according to Becker's (1975) prediction, if training is at least partly general (as opposed to firm specific), one would expect a negative sign on the coefficient of the ongoing training variable. Then, in our IMMEE firms, the workers partly compensate for the provided training by accepting a lower wage during their training period. Since the evidence for such effect is often ambiguous

[23] For a review of the magnitude of the returns to training see Frazis and Loewenstein (2003).

in US data, it is useful to obtain some evidence from Tunisian data. As shown by the estimates, they ultimately benefit from this training which provides them with a large positive wage premium when training is completed.

Another interesting variable is the one indicating whether the worker's wage is close to the legal minimum wage. There are evidences of two contradictory effects depending on the sector. In the textile sector, the impact of this variable on wage differentials is positive and significantly different from zero (equations 3, 4 and 5 in Table 3). However, in quantile estimates, the sign of its coefficient becomes negative for quantiles 0.5 and 0.75. Moreover, in IMMEE sector, there is no significant impact of the SMIG on wage differentials. In contrast, it does affect workers' wage negatively when we look at its effect across the three categories of conditional wages in quantile estimates. Further empirical elements seem necessary to understand these results. However, they suggest that the impact of the SMIG on wages is largely industry specific and that it affects in an opposite way observed wages and unobserved heterogeneity at different conditional wage levels.

Finally, while the estimates of the textile firm dummies' coefficients are never statistically significant, those of IMMEE firms are often large and significant at the 1 percent level (except for firms 1 and 2 when wage quartile dummies are included). For the IMMEE industry, this is in accordance with the usual persistence of wage differentials across individuals with identical productive characteristics. Such wage differentials have been found in Tunisia in non-matched data (Abdennadher et al., 1994). This result shows that workers with comparable measured characteristics earn different wages partly because they belong to different firms. In this respect, Muller and Nordman (2004) have found that these firm effects can largely be explained by the firms' human capital features and by the existence of intra-firm human capital externalities. Most likely, the observed IMMEE firms are able to foster human

capital diffusion across workers, unlike the observed textile firms, as a result of their higher management and supervision rates, mean education and experience.

4. Conclusion

In this paper, we study the returns to human capital variables across wage levels in two industrial sectors of the Tunisian matched worker-firm data in 1999. With or without controlling for firm characteristics and for possible endogeneity of the education variable, our results show that workers belonging to the IMMEE sector benefit from higher returns to human capital than their counterparts in the Textile-clothing industry. Moreover, in the IMMEE firms, low wage workers (as defined in terms of wages or conditional wages) experience greater returns to experience and tenure variables than high wage workers. Using 2SLS estimates narrows the gap in the return to education across sectors. Nevertheless, IMMEE workers continue benefiting from greater returns to tenure and experience than their counterparts in textile firms.

Meanwhile, in the IMMEE sector and from both OLS and 2SLS estimates, low wage workers seem better off than high wage workers as for their returns to human capital. In contrast, in the Textile sector, the high wages always get greater rewards for their human capital endowments. We also performed quantile regressions for three different conditional wage categories and found that there is indeed a higher return to education for the high wage workers in textile firms. Secondly, in the IMMEE sector, workers at the bottom of the conditional wage distribution benefit from important returns to human capital and there is a persistence of a U curve describing the return to human capital along this distribution.

The wage premium for any completed training amounts to about 55 percent in textile firms and to about 17 percent for IMMEE firms. However, taking into account whether formal

training is still ongoing at the time of the survey, our regression results clearly indicate that workers bear heavy costs for their formal training: individuals benefiting from training during an initial period receive a lower wage than what they could get without training. This is consistent with general predictions of human capital theory. Workers get returns from their training at a later period through the higher wages. According to Becker's (1975) prediction, training would be then entirely general in our Tunisian surveyed firms.

Let us turn to policy implications. The emerging tensions in the Tunisian labour market have adverse consequences in terms of job tenure uncertainty and negative pressure on wages for lower-skilled workers. Developing education and formal training can be viewed as a response to these tensions. Our results show that on-the-job training and education can be efficient channels of policies aiming at raising earnings for low wages as well as high wages workers. However, careful consideration of the industrial sector should accompany these policies since specific impact of education, experience, OJT are found in the studied sectors.

There are also important poverty issues in Tunisia. Poverty has been found to be more concentrated in the textile sector among manufacturing sectors. This is consistent in our data with lower wages observed in the textile sector. We find that the return to on-the-job human capital investment is particularly high for low wages in this industry. Therefore, this sector could play a role of skill promoter for low-skilled manpower in the context of a joint design of education and industry policies.

APPENDIX

Table 1. Firms' descriptive statistics

	Textile sector				IMMEE sector			
Variables	*Mean*	*Standard deviation*	*min*	*max*	*Mean*	*Standard deviation*	*min*	*max*
Mean education of employees in the firm	8.90	1.22	7.76	10.58	11.25	3.15	8.62	15.40
Mean tenure of employees in the firm	4.94	1.42	2.90	6.04	6.69	5.17	1.43	13.60
Mean total experience of employees in the firm	8.20	1.79	6.58	10.57	9.79	5.48	3.61	16.9
Mean age of employees in the firm	28.41	2.37	26.19	31.23	31.03	3.03	28.46	34.55
Work independence stimulated (1: yes; 0: no)	0.25	0.50	0	1	0.25	0.50	0	1
Level of stimulated internal communication (1 to 3)	0.50	0.58	0	1	1.75	1.50	0	3
Level of competition (1 to 5)	4.50	0.58	4	5	1.75	0.96	1	3
Regular work control (1: yes; 0: no)	0.50	0.58	0	1	0.50	0.58	0	1
Age of the firm	10.75	4.92	5.00	17.00	10.13	7.28	3.50	20.00
Number of intermediary levels of management	5.00	0.00	5	5	5.00	0.82	4	6
Size (number of employees)	178.25	132.56	90	371	84.25	17.86	70	107
Existing system of formal training (1: yes; 0: no)	0.00	0.00	0	0	0.50	0.58	0	1
Task definition (1: globally defined; 0: precisely defined)	0.00	0.00	0	0	0.50	0.58	0	1
Organizational innovation the last four years (1: yes; 0: no)	0.50	0.58	0	1	0.50	0.58	0	1
Technological innovation the last four years (1: yes; 0: no)	0.75	0.50	0	1	0.50	0.58	0	1
Percentage of exported production	1.00	0.00	1	1	0.21	0.28	0	0.60
Exportation (1: yes; 0: no)	1.00	0.00	1	1	0.50	0.58	0	1
System of versatility implemented (1: yes; 0: no)	0.75	0.50	0	1	0.50	0.58	0	1
Percentage of employees working in chain	0.72	0.22	0.43	0.91	0.00	0.00	0.00	0.00
Rate of supervision	0.06	0.01	0.05	0.07	0.15	0.08	0.08	0.25
Rate of management	0.04	0.01	0.02	0.05	0.25	0.39	0.06	0.83
Firms' fixed effects								
Firm 1					0.292	0.457	0	1
Firm 2					0.349	0.479	0	1
Firm 3	0.264	0.442	0	1				
Firm 4	0.24	0.428	0	1				
Firm 5	0.24	0.428	0	1				
Firm 6					0.189	0.393	0	1
Firm 7					0.170	0.377	0	1
Firm 8	0.256	0.438	0	1				

Table 2. Descriptive statistics of the workers' characteristics

	Textile sector				IMMEE sector			
Variables	*Mean*	*Standard deviation*	*min*	*max*	*Mean*	*Standard deviation*	*min*	*max*
N	125				106			
Age of individuals (AGE)	28.328	7.203	15.000	52	30.953	8.207	18	52
Sex (FEMALE, 1: woman; 0 man; conversely for MALE)	0.864	0.344	0	1	0.066	0.250	0	1
Geographical origin (PROVE, 1: rural area; 0 otherwise)	0.152	0.360	0	1	0.142	0.350	0	1
Matrimonial situation (MARI, 1: if married; 0 if divorced, widowed or single)	0.336	0.474	0	1	0.406	0.493	0	1
Single male (CELIBAH, 1: yes; 0 otherwise)	0.088	0.284	0	1	0.557	0.499	0	1
Number of dependant children (ENFT)	0.488	0.930	0	5	0.689	1.190	0	5
Father has a level of Primary school (PPRIM, 1: yes; 0 otherwise)	0.192	0.395	0	1	0.151	0.360	0	1
Father has a level of Secondary school (PSECON, 1: yes; 0 otherwise)	0.128	0.335	0	1	0.208	0.407	0	1
Father has a level of Higher education (PSUP, 1: yes; 0 otherwise)	0.064	0.246	0	1	0.198	0.400	0	1
Father is illiterate (PANAL, 1: yes; 0 otherwise)	0.184	0.389	0	1	0.208	0.407	0	1
Years of schooling (EDUCATION)	8.910	3.439	0	18	10.580	4.182	2	17
Previous apprenticeship in a firm (APPRENTI, 1: yes; 0 otherwise)	0.400	0.492	0	1	0.321	0.469	0	1
Periods of internship related to the current job (STAGA, in months)	0.920	2.778	0	18	2.113	4.332	0	24
Periods of internship not related to the current job (STAGAN, in months)	0.004	0.045	0	0.5	0.017	0.079	0	0.5
Periods of unemployment (CHOMA, in years)	2.012	3.578	0	18	0.645	1.158	0	5
Previous relevant experience (EMSIM, 1: yes; 0 otherwise)	0.552	0.499	0	1	0.557	0.499	0	1
Previous total professional experience (EXPERIENCE, in years)	3.240	4.701	0	22	3.286	4.698	0	22
Start date in the current firm (ENTREE)	1993.17	3.723	1980	1997.9	1991	7.577	1968	1997.9
Tenure in the current firm (TENURE, in years)	4.913	3.723	0.167	17.333	7.059	7.577	0.167	30.083
Formal training received in the current firm (FORMAD, 1: yes; 0 otherwise)	0.016	0.126	0	1	0.377	0.487	0	1
Formal training period in the current firm in years (FORMAA)	0.003	0.027	0	0.25	0.195	0.457	0	3
Ongoing formal training in the current firm (FORSTIL, 1: yes; 0 otherwise)	0.000	0.000	0	0	0.038	0.191	0	1
Member of an union (SYNDIC, 1: yes; 0 otherwise)	0.048	0.215	0	1	0.387	0.489	0	1
Work in team (EQUIPE, 1: yes; 0 otherwise)	0.216	0.413	0	1	0.547	0.500	0	1
Work in chain (CHAINE, 1: yes; 0 otherwise)	0.592	0.493	0	1	0.000	0.000	0.00	0.00
Executive or supervisor (ENCADR, 1: yes; 0 otherwise)	0.184	0.389	0	1	0.198	0.400	0	1
Hourly wage (SALH, in dinars)	1.384	0.898	0.292	6.1698	2.493	1.532	0.586	7.572
Log of hourly wage (LNSALH)	0.201	0.460	-1.232	1.8196	0.753	0.561	-0.535	2.024
Monthly wage (SAL, in dinars)	246.691	160.023	52	1100	395.838	273.642	87	1350
Proximity to the minimum wage (SMIG, 1: if 156<=SAL<=178; 0 otherwise)	0.176	0.382	0	1	0.0188	0.136	0	1

Figure 1. Distribution of Observed Monthly Wages of all Workers (Textile and IMMEE)

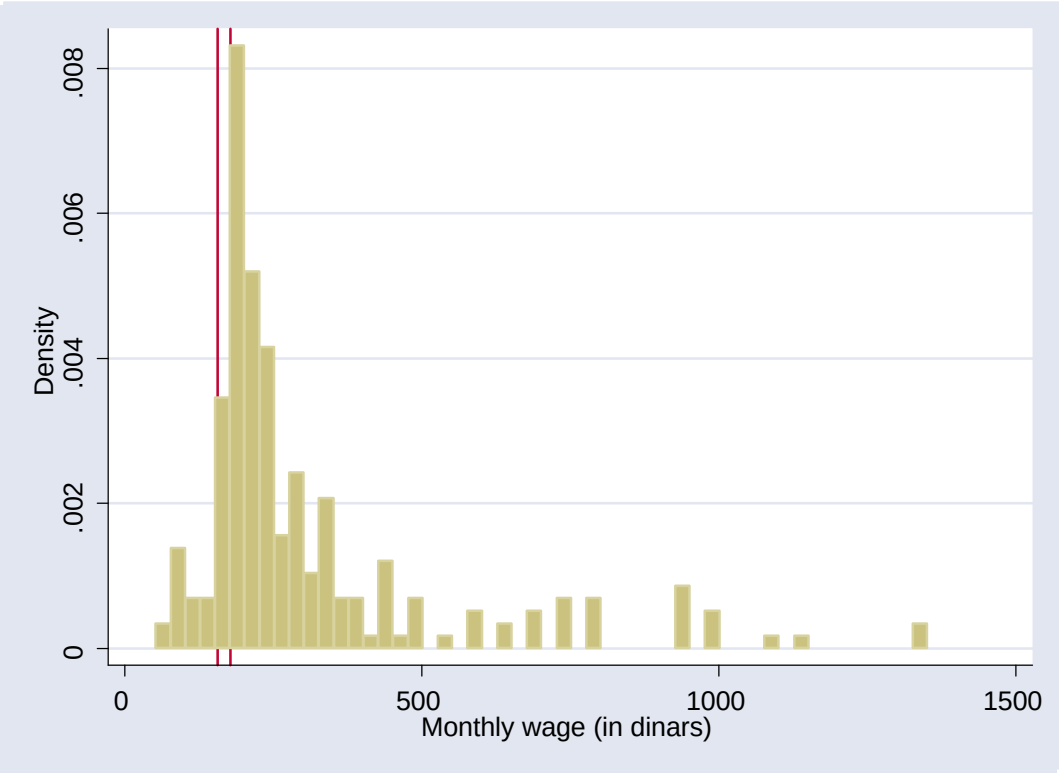

Figure 2. Distribution of Observed Monthly Wages of Workers in the Textile Sector

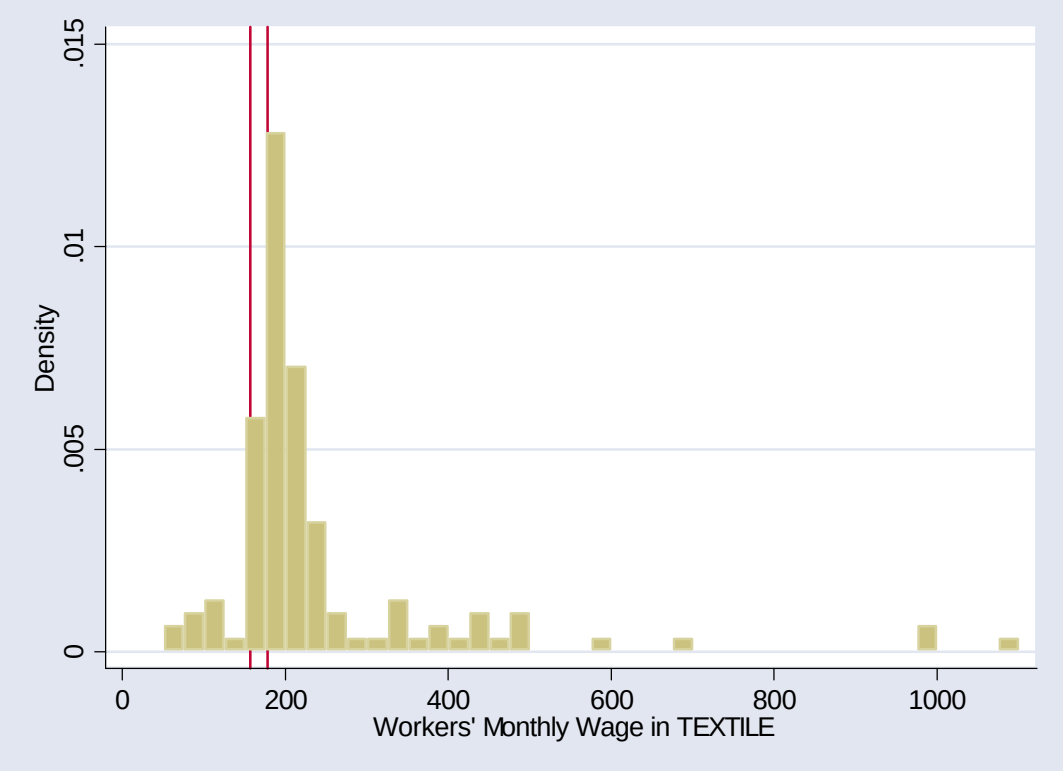

Figure 3. Distribution of Observed Monthly Wages of Workers in the IMMEE Sector

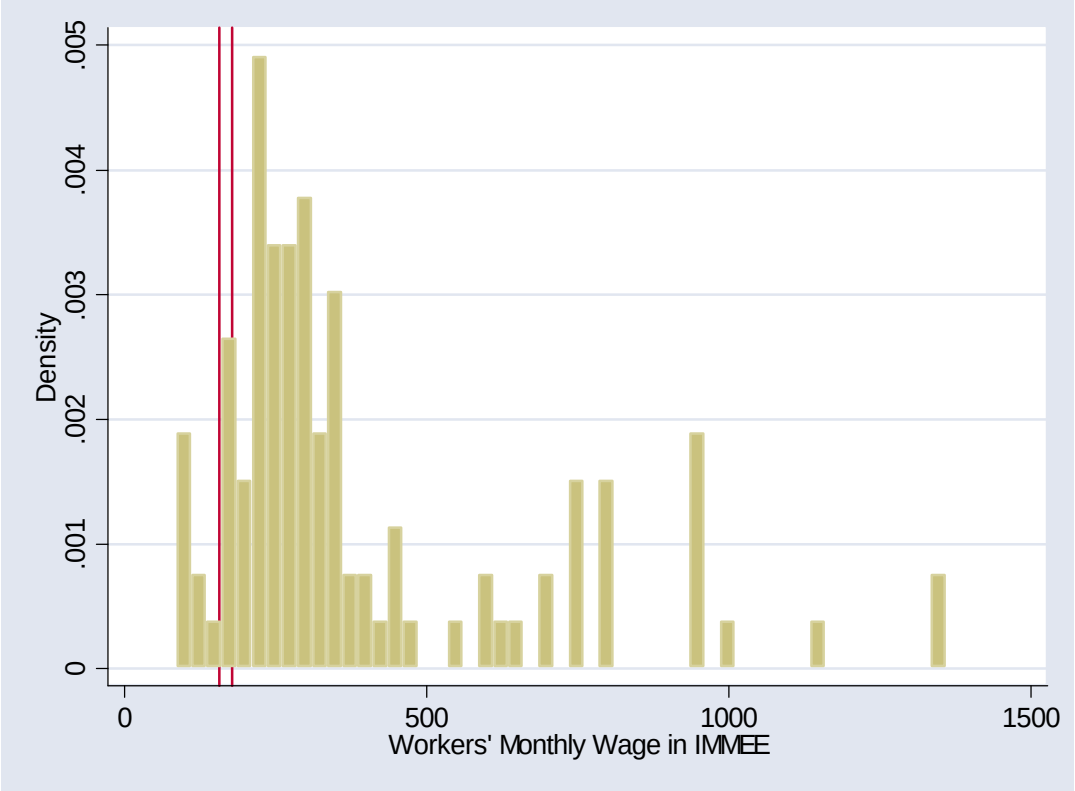

Table 3. Wage Equations for Workers in the Textile Sector

Dependent variable: Log hourly wage (LNSALH)

	OLS	**OLS**	**OLS**	**OLS**	**IV (2SLS)**	**Quantile regressions (bootstrap standard error: 20 iterations)** Firm fixed effects models		
Explanatory variables		Firm fixed effects model		Firm fixed effects model	Firm fixed effects model	*0.25 Quantile*	*0.50 Quantile*	*0.75 Quantile*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	-0.5203***	-0.4941***	0.0777	0.1389	-0.0030	-0.0075	0.5509*	0.2422
	(3.62)	(3.18)	(0.52)	(0.87)	(0.01)	(0.02)	(1.91)	(0.62)
Education	0.0551***	0.0538***	0.0039	0.0030	0.0161	0.0189	0.0160	0.0397**
	(6.14)	(5.71)	(0.36)	(0.27)	(0.63)	(1.01)	(1.42)	(1.98)
Tenure	0.0885***	0.0894***	0.0429**	0.0383**	0.0684**	0.0431	0.0103	0.0200
	(4.47)	(4.25)	(2.53)	(2.19)	(2.59)	(1.08)	(0.53)	(0.46)
$Tenure^2$	-0.0033**	-0.0035**	-0.0030**	-0.0028**	-0.0054***	-0.0012	0.0007	0.0002
	(2.35)	(2.33)	(2.35)	(2.09)	(3.01)	(0.52)	(0.52)	(0.06)
Experience	0.0361**	0.0377**	0.0064	0.0029	-0.0090	0.0184	0.0024	0.0158
	(2.50)	(2.32)	(0.51)	(0.20)	(0.45)	(0.66)	(0.24)	(0.67)
$Experience^2$	-0.0003	-0.0004	-0.0002	-0.0000	0.0014	-0.0002	0.0007	0.0005
	(0.35)	(0.42)	(0.21)	(0.03)	(1.27)	(0.14)	(0.80)	(0.46)
QUARTILE1	_	_	-0.7846***	-0.7965***	-0.5357	_	_	_
			(4.28)	(4.30)	(1.13)			
QUARTILE4	_	_	-0.5161**	-0.5812**	-0.5498	_	_	_
			(2.04)	(2.22)	(1.12)			
Education*QUARTILE1	_	_	0.0061	0.0067	-0.0012	_	_	_
			(0.33)	(0.36)	(0.02)			
Education*QUARTILE4	_	_	0.0595***	0.0636***	0.0571*	_	_	_
			(3.26)	(3.38)	(1.68)			
Tenure*QUARTILE1	_	_	0.0243	0.0157	-0.0333	_	_	_
			(1.09)	(0.66)	(0.64)			
Tenure*QUARTILE4	_	_	0.0339**	0.0353**	0.0515*	_	_	_
			(2.40)	(2.44)	(1.84)			
Experience*QUARTILE1	_	_	0.0099	0.0112	0.0316	_	_	_
			(0.52)	(0.58)	(0.59)			
Experience*QUARTILE4	_	_	0.0296***	0.0294***	0.0037	_	_	_
			(2.71)	(2.66)	(0.18)			

Ongoing formal training	_	_	_	_	_	_	_	_
Completed formal training	0.5582**	0.5617**	0.5381***	0.5525***	0.6298***	0.5282	0.0175	0.3713
	(2.55)	(2.53)	(3.19)	(3.24)	(3.22)	(1.20)	(0.04)	(1.39)
Executive or supervisor	0.1847**	0.1906**	0.0069	0.0126	0.0606	0.1088	0.1459	0.3307**
	(2.02)	(2.05)	(0.09)	(0.16)	(0.64)	(1.10)	(0.79)	(2.28)
Proximity to the minimum wage	-0.0450	-0.0337	0.4811***	0.5087***	0.4852*	0.0259	-0.0824**	-0.1122*
	(0.66)	(0.46)	(4.49)	(4.63)	(1.72)	(0.39)	(2.11)	(1.77)
Female	-0.2553***	-0.2565***	-0.1230*	-0.1296*	-0.1413	-0.2997	-0.6428***	-0.5050***
	(2.99)	(2.96)	(1.75)	(1.82)	(1.58)	(1.45)	(2.93)	(3.51)
Firm3	_	-0.0435	_	-0.0554	-0.1006	-0.1002	-0.0490	-0.0476
		(0.58)		(0.96)	(1.48)	(1.25)	(0.74)	(0.62)
Firm4	_	-0.0279	_	0.0235	0.0161	-0.1486	-0.0521	0.0491
		(0.34)		(0.35)	(0.18)	(1.19)	(0.76)	(0.33)
Firm8	_	0.0020	_	-0.0416	-0.0889	-0.0317	-0.0398	-0.0103
		(0.02)		(0.65)	(1.22)	(0.32)	(0.67)	(0.09)
R^2	0.66	0.66	0.83	0.83	0.79			
Pseudo R^2						0.27	0.36	0.54
Observations	125	125	125	125	125	125	125	125

t-statistics are given in parentheses. ***, ** and * mean respectively significant at the 1%, 5% and 10% levels.

The instrumented variables in the IV regression (5) are: Education QUARTILE1 QUARTILE4 Education*QUARTILE1 Education*QUARTILE4 Tenure*QUARTILE1 Tenure*QUARTILE4 Experience*QUARTILE1 Experience*QUARTILE4

The additional instruments used in the IV regression (besides the exogenous variables of equation 5) include: age, $(age)^2$, apprenti, celibah, chaine, choma, $(choma)^2$, choma*female, emsim, enft, $(enft)^2$, log(enft), enft*age, entree, equipe, formaa, $(formaa)^2$, $(formaa)^3$, formaa*female, forstil*female, mari*female, mari*female, mari*male, panal, panal*age, panal*choma, panal*enft, panal*formaa, pprim, pprim*age, pprim*choma, pprim*enft, pprim*formaa, psecon, psecon*age, psecon*choma, psecon*enft, psecon*formaa, psup, psup*age, psup*choma, psup*enft, psup*formaa, staga, $(staga)^2$, $(staga)^3$, stagan, $(stagan)^2$, $(stagan)^3$.

The definitions of the variables and instruments appear in Table 1.

Table 4. Wage Equations for Workers in the IMMEE Sector

Dependent variable: Log hourly wage (LNSALH)

	OLS	**OLS**	**OLS**	**OLS**	**IV (2SLS)**	**Quantile regressions (bootstrap standard error: 20 iterations)** Firm fixed effects models		
Explanatory variables		Firm fixed effects model		Firm fixed effects model	Firm fixed effects model	*0.25 Quantile*	*0.50 Quantile*	*0.75 Quantile*
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Constant	-0.5623***	-0.0883	0.2299*	0.3382**	0.2789	-0.2217	0.4491*	0.3290
	(4.42)	(0.53)	(1.75)	(2.10)	(1.29)	(0.63)	(1.69)	(1.17)
Education	0.0935***	0.0796***	0.0288***	0.0317***	0.0316**	0.0857***	0.0556***	0.0656***
	(9.32)	(7.78)	(3.10)	(3.34)	(2.58)	(4.43)	(3.72)	(3.86)
Tenure	0.0028	0.0280**	-0.0011	0.0016	-0.0100	0.0392**	0.0252	0.0242
	(0.21)	(2.17)	(0.11)	(0.15)	(0.73)	(2.00)	(1.55)	(1.20)
$Tenure^2$	0.0003	-0.0005	0.0003	0.0002	0.0006	-0.0006	-0.0003	-0.0004
	(0.58)	(0.90)	(0.77)	(0.39)	(1.24)	(0.75)	(0.52)	(0.48)
Experience	0.0560***	0.0607***	0.0260*	0.0288**	0.0417**	0.0755***	0.0367	0.0599***
	(3.12)	(3.85)	(1.90)	(2.12)	(2.44)	(3.56)	(1.54)	(2.77)
$Experience^2$	-0.0019*	-0.0024***	-0.0010	-0.0013*	-0.0018**	-0.0036**	-0.0012	-0.0028
	(1.89)	(2.66)	(1.33)	(1.73)	(2.02)	(2.38)	(0.90)	(1.61)
QUARTILE1	_	_	-0.4875**	-0.4943**	-0.6240**	_	_	_
			(2.50)	(2.55)	(2.38)			
QUARTILE4	_	_	0.2156	-0.2609	-0.0833	_	_	_
			(0.44)	(0.48)	(0.10)			
Education*QUARTILE1	_	_	-0.0063	-0.0107	-0.0086	_	_	_
			(0.33)	(0.56)	(0.32)			
Education*QUARTILE4	_	_	0.0317	0.0502	0.0455	_	_	_
			(1.07)	(1.63)	(1.01)			
Tenure*QUARTILE1	_	_	0.0348**	0.0368**	0.0668**	_	_	_
			(2.27)	(2.39)	(2.37)			
Tenure*QUARTILE4	_	_	-0.0133	-0.0022	-0.0115	_	_	_
			(1.49)	(0.20)	(0.77)			
Experience*QUARTILE1	_	_	0.0175	0.0200*	0.0071	_	_	_
			(1.53)	(1.77)	(0.45)			
Experience*QUARTILE4	_	_	0.0015	0.0138	-0.0057	_	_	_
			(0.09)	(0.75)	(0.20)			

Ongoing formal training	-0.6246***	-0.4526***	-0.3653***	-0.3326***	-0.3251***	-0.3452	-0.5285**	-0.2375
	(3.65)	(2.95)	(3.49)	(3.18)	(2.88)	(1.14)	(2.07)	(0.76)
Completed formal training	0.3321***	0.2268***	0.1661***	0.1581***	0.1730***	0.2201**	0.2173***	0.1396
	(4.74)	(3.05)	(3.65)	(3.03)	(3.02)	(2.40)	(2.80)	(1.40)
Executive or supervisor	0.2540***	0.2476***	0.1395**	0.1483**	0.1524**	0.1589*	0.1711*	0.2820**
	(2.81)	(3.07)	(2.38)	(2.50)	(2.04)	(1.80)	(1.98)	(2.35)
Proximity to the minimum wage	-0.1707	-0.2595	-0.1260	-0.1441	-0.2669	-0.2457*	-0.4482**	-0.3254*
	(0.75)	(1.28)	(0.78)	(0.90)	(1.29)	(1.97)	(2.31)	(1.67)
Female	0.0068	-0.0535	-0.0121	0.0027	0.0030	-0.2359	-0.0615	-0.0746
	(0.05)	(0.48)	(0.14)	(0.03)	(0.03)	(0.98)	(0.28)	(0.30)
Firm1	_	-0.4534***	_	-0.1164	-0.0284	-0.6607***	-0.7573***	-0.5584***
		(4.18)		(1.31)	(0.25)	(3.47)	(4.05)	(3.53)
Firm2	_	-0.4248***	_	-0.1022	0.0054	-0.5729***	-0.6337***	-0.5271***
		(4.08)		(1.10)	(0.04)	(2.98)	(4.66)	(3.07)
Firm7	_	-0.5775***	_	-0.2209**	-0.1207	-0.7328***	-0.6949***	-0.6268***
		(5.61)		(2.17)	(0.85)	(4.24)	(4.45)	(4.62)
R^2	0.73	0.80	0.91	0.92	0.91			
Pseudo R^2						0.52	0.56	0.65
Observations	106	106	106	106	106	106	106	106

t-statistics are given in parentheses. ***, ** and * mean respectively significant at the 1%, 5% and 10% levels.

The instrumented variables in the IV regression (5) are: Education QUARTILE1 QUARTILE4 Education*QUARTILE1 Education*QUARTILE4 Tenure*QUARTILE1 Tenure*QUARTILE4 Experience*QUARTILE1 Experience*QUARTILE4

The additional instruments used in the IV regression (besides the exogenous variables of equation 5) include: age, $(age)^2$, apprenti, celibah, chaine, choma, $(choma)^2$, choma*female, emsim, enft, $(enft)^2$, log(enft), enft*age, entree, equipe, formaa, $(formaa)^2$, $(formaa)^3$, formaa*female, forstil*female, mari*female, mari*female, mari*male, panal, panal*age, panal*choma, panal*enft, panal*formaa, pprim, pprim*age, pprim*choma, pprim*enft, pprim*formaa, psecon, psecon*age, psecon*choma, psecon*enft, psecon*formaa, psup, psup*age, psup*choma, psup*enft, psup*formaa, staga, $(staga)^2$, $(staga)^3$, stagan, $(stagan)^2$, $(stagan)^3$.

The definitions of the variables and instruments appear in Table 1.

Table 5. Returns to Human Capital Across Wage Quartiles and Sectors with Firm Fixed Effects Models

	OLS				**2SLS**				**Quantile regressions**		
	Quartiles				Quartiles						
Independent variables	1st	2nd and 3rd	4th	*mean*[b]	1st	2nd and 3rd	4th	*mean*[b]	*0.25 Quantile*	*0.50 Quantile*	*0.75 Quantile*
	Textile										
Education	0.0097 [ns]	0.0030 [ns]	0.0665	*0.0205*	0.0149 [ns]	0.0161 [ns]	0.0733	*0.0301*	0.0189 [ns]	0.0160 [ns]	0.0397
Tenure[a]	0.0331	0.0116	0.0369	*0.0233*	-0.0050	0.0174	0.0496	*0.0199*	0.0312 [ns]	0.0168 [ns]	0.0216 [ns]
Experience[a]	0.0140 [ns]	0.0027 [ns]	0.0320	*0.0129*	0.0273 [ns]	-0.0001 [ns]	0.0076 [ns]	*0.0087*	0.0168 [ns]	0.0071 [ns]	0.0192 [ns]
	IMMEE										
Education	0.0210	0.0317	0.0819	*0.0415*	0.0230	0.0316	0.0771	*0.0408*	0.0857	0.0556	0.0656
Tenure	0.0392	0.0046 [ns]	0.0010 [ns]	*0.0124*	0.0600	0.0018 [ns]	-0.0155 [ns]	*0.0120*	0.0308	0.0212 [ns]	0.0183 [ns]
Experience	0.0414	0.0188	0.0374	*0.0291*	0.0380	0.0272	0.0284	*0.0302*	0.0520	0.0287 [ns]	0.0417

[a] : returns calculated at the average point of the sub-sample. [b] : mean of the effects for the different quartiles. [ns] : no significantly different from zero at 10% level.

References

Abadie A., Angrist, J., and Imbens G., 2002, "Instrumental Variables Estimates of the Effect of Subsidized Training on the Quantiles of Trainee Earnings," *Econometrica*, 70(1), pp. 91-117.

Abdennadher C., Karaa, A. and Plassard J.-M., 1994, "Tester la dualité du marché du travail: l'exemple de la Tunisie," *Revue d'Économie du Développement*, 2, pp. 39-63.

Abowd J.M. and Kramarz F., 1999, "The Analysis of Labor Markets Using Matched Employer-Employee Data," in Ashenfelter O. and Card D. (eds), *Handbook of Labor Economics*, vol. 3B, Elsevier Science Publishers BV, Pays-Bas, pp. 2629-2710.

Abowd J.M., Kramarz F. and Margolis D. N., 1999, "High-Wage Workers and High-Wage Firms," *Econometrica*, 67(2), pp. 251-333.

Abowd J.M., Kramarz F., Margolis D. N. and Troske K. R., 2000, "Politiques salariales et performances des entreprises : une comparaison France/Etats-Unis," *Économie et Statistique*, 332-333(2), pp. 27-38.

Barron J.M., Berger M.C. and Black D.A., 1998, "Do Workers Pay for On-the-Job Training," *The Journal of Human Resources*, 34(2), pp. 235-252.

Belhareth M. and Hergli M., 2000, *Flexibilité de l'emploi et redéploiement des ressources humaines : cas de la Tunisie*, Tunis, Arforghe Editions.

Behrman J.R. and Birdsall. N., 1983, "The Quality of Schooling: Quantity Alone Is Misleading," *American Economic Review*, 73(5), pp. 928-946.

Buchinsky M., 1998, "Recent Advances in Quantile Regression Models: A Practical Guideline for Empirical Research," *The Journal of Human Resources*, 33(1), pp. 88-126.

Buchinsky M., 2001, "Quantile Regression with Sample Selection: Estimating Women's Return to Education in the U.S.," *Empirical Economics*, *2*6(1), pp. 87-113.

Card D., 1999, "The Causal Effect of Education on Earnings," in Ashenfelter O. and Card D. (eds), *Handbook of Labor Economics*, vol. 3A, Elsevier Science Publishers BV, Netherlands, pp. 1801-1863.

CNUCED-UNDP, 2001, "Partenariat pour la mondialisation, la libéralisation et le développement humain durable. L'intégration de la Tunise dans l'économie mondiale : Opportunités et défis", May.

Destré G. and Nordman C., 2002, "The Impacts of Informal Training on Earnings: Evidence from French, Moroccan and Tunisian Matched Employer-Employee Data," *SSRN Electronic Library, Human Capital Journal.* Published in French in *L'Actualité Économique*, 78(2), pp. 179-205.

Frazis H. and Loewenstein M. A., 2003, "Reexamining the Returns to Training: Functional Form, Magnitude, and Interpretation," Working Paper 367, Bureau of Labor Statistics, July.

Goux D. and Maurin É., 1999, "Persistence of Interindustry Wage Differentials: A Reexamination Using Matched Worker-Firm Panel Data," *Journal of Labor Economics*, 17(3), pp. 492-533.

Hahn J., 1995, "Bootstrapping Quantile Regression Estimators," *Econometric Theory*, 11, pp. 105-121.

Hashimoto M., 1982, "Minimum Wage Effects on Training on the Job," *American Economic Review*, 72(5), pp. 1070-1087.

Hoddinott J., 1996, "Wages and Unemployment in an Urban African Labour Market," *The Economic Journal*, 106, pp. 1610-1626.

Katz L.F., 1986, "Efficiency Wage Theories: A Partial Evaluation," in S. Fisher (ed), *NBER Macroeconomics Annual*, Cambridge, Mass., MIT Press.

Koenker R. and Bassett G., 1978, "Regression Quantiles," *Econometrica*, 46, pp. 33-50.

Krueger A. B. and Summers L. H., 1988, "Efficiency Wages and the Inter-Industry Wage Structure," *Econometrica*, 56(2), pp. 259-293.

Leighton L. and Mincer J., 1981, "The effects of Minimum Wages on Human Capital Formation," in S. Rottemburg (ed), *The Economics of Legal Minimum Wages*, Washington, DC: American Enterprise Institute, 1981.

Lynch L. M., 1992, "Private-Sector Training and the Earnings of Young Workers," *American Economic Review*, 82(1), pp. 299-312.

Machado J. and Mata J., 2001, "Earning Functions in Portugal 1982-1984: Evidence from Quantile Regressions," *Empirical Economics*, 26, pp. 115-134.

Martins P.S. and Pereira P.T., 2004, "Does Education Reduce Wage Inequality? Quantile Regression Evidence from 16 Countries," *Labour Economics*, 11, pp. 355-371.

Mincer J., 1993, *Schooling, Experience, and Earnings*, New York: Gregg Revivals, 1993.

Muller C., 2004, "Poverty Incidence and Poverty Change in Tunisia 1990-95," Discussion Paper Universidad de Alicante.

Muller C. and Nordman C., 2004, "Which Human Capital Matters for Rich and Poor's Wages? Evidence from Matched Worker-Firm Data from Tunisia," Discussion Paper IVIE-Universidad de Alicante. DIAL Working Paper, DT DIAL 2004/09.

Murphy K. M. and Topel R. H., 1987, "Unemployment, Risk, and Earnings: Testing for Equalizing Wage Differences in the Labor Market," in K. Lang and J. S. Leonard (eds), *Unemployment and the Structure of Labor Markets*, London, Basil Blackwell.

Nordman C., 2002a, *Formation du capital humain et diffusion du savoir dans l'entreprise: analyse économétrique sur données appariées marocaines et tunisiennes*, Ph.D. Dissertation, Université de Paris-I Panthéon-Sorbonne.

Nordman C., 2002b, "Diffusion du capital humain et effets d'entreprise: Approche par frontière de gains sur données appariées marocaines et tunisiennes," *Revue Economique*, 53(3), pp. 647-658.

Nordman, 2004, "Discrimination salariale, capital humain et structure des tâches selon le genre: l'apport de données liées employeurs-employés au Maroc et en Tunisie,"

in Achy, de Henau, El Kadiri, Kateb, Laufer, Marry, Maruani, Meulders, Silvera, Sofer and Zouari (eds), *Marché du travail et genre : Maghreb-Europe*, Chap. 2, Brussels: Editions du DULBEA, forthcoming.

Parent, D., 1999, "Wages and Mobility: The Impact of Employer-Provided Training," *Journal of Labor Economics*, 12(2), pp. 298-317.

Rosen S., 1986, "The Theory of Equalizing Differences," in *Handbook of Labor Economics*, vol. 1, chap.12, Ashenfelter O. and Layard R. (eds).

Sahn D.E. and Alderman H., 1988, "The Effects of Human Capital on Wages and the Determinants of Labor Supply in a Developing Country," *Journal of Development Economics*, 29, pp. 157-183.

Teal F., 1996, "The Size and Sources of Economic Rents in a Developing Country Manufacturing Labour Market," *The Economic Journal*, 106, 963-976, July.

The World Bank, 2001, "Republic of Tunisia: Social and Structural Review 2000. Integrating into the World Economy and Sustaining Economic and Social Progress," Washington.

UNDP, 1994, *Le PNUD en Tunisie*, Tunis.

Willis R., 1986, "Wage Determinants: a Survey and Reinterpretation of Human Capital Earnings Functions," in *Handbook of Labor Economics*, vol. 1, Chap.10, Ashenfelter O. and Layard R. (eds).