

Economics Department

Productivity, Seniority
and Wages

New Evidence from Personnel Data

LUCA FLABBI
and
ANDREA ICHINO

ECO No. 98/11

EUI WORKING PAPERS



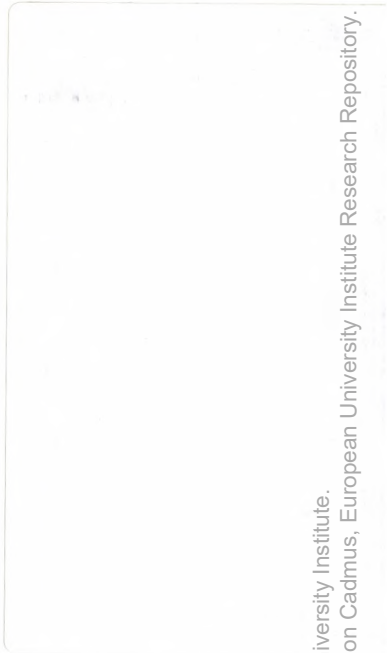
EUROPEAN UNIVERSITY INSTITUTE

WP
330
EUR

European University Institute



3 0001 0036 8776 3



© The Author(s). European University Institute.

Digitised version produced by the EUI Library in 2020. Available Open Access on Cadmus, European University Institute Research Repository.

EUROPEAN UNIVERSITY INSTITUTE, FLORENCE

ECONOMICS DEPARTMENT



EUI Working Paper ECO No. 98/11

**Productivity, Seniority and Wages
New Evidence from Personnel Data**

LUCA FLABBI*
and
ANDREA ICHINO**

* Università Bocconi
** EUI, IGER and CEPR

BADIA FIESOLANA, SAN DOMENICO (FI)

All rights reserved.
No part of this paper may be reproduced in any form
without permission of the authors.

© Luca Flabbi and A. Ichino
Printed in Italy in April 1998
European University Institute
Badia Fiesolana
I - 50016 San Domenico (FI)
Italy

Productivity, Seniority and Wages

New Evidence from Personnel Data

Luca Flabbi
(Università Bocconi)

Andrea Ichino
(Istituto Universitario Europeo, IGIER and CEPR) *

March 9, 1998

Abstract

Wages may be observed to increase with seniority because of firm-specific human capital accumulation or because of self-selection of better workers in longer jobs. In both these cases the upward sloping wage profile in cross sectional regressions would reflect higher productivity of more senior workers. If this were true, the observation of an effect of seniority on wages would depend on the presence of controls for individual productivity. In this paper we replicate, using personnel data from a large Italian firm, the results of the pioneering work of Medoff and Abraham (1980 and 1981) in which supervisors' evaluations were used as productivity indicators. Since the validity of supervisors' evaluations as measures of productivity has been widely criticised, we extend the work of Medoff and Abraham using different direct measures of productivity based on recorded absenteeism and misconduct episodes. Both these indicators and supervisors' evaluation suggest that the observed effect of seniority on wages does not reflect a higher productivity of more senior workers. Theories in which wages are deferred for incentive or insurance reasons are therefore more likely to explain the observed upward sloping profile.

Keywords: Wage determination, Returns to Seniority, Productivity.

JEL Classification: J30, J31

*Address correspondence to: Luca Flabbi, IGIER - Università Bocconi, via Salasco 5, 20136 Milano, Italia, e-mail: ra1.igier@uni-bocconi.it; Andrea Ichino, Istituto Universitario Europeo, 50016 San Domenico di Fiesole, (FI), Italia, e-mail: ichino@datacomm.iue.it We would like to thank: the firm that kindly provided the data; Pietro Ichino, Maria Benvenuti, Robert Waldmann, Rudolf Winter-Ebmer and seminar participants at the 1997 AIEL Conference for their comments and suggestions; Elena Belli, Anna Fruttero, Raffaele Tangorra and Federico Targetti for excellent research assistantship. All errors are ours.

1 Introduction

In a recent evaluation of the existing literature on incentives and careers in organizations, Robert Gibbons (1996) invited empirical researchers to "provide evidence on a core set of questions before studying specific issues of their own." Two of these questions ask whether "wage increases and promotions are more likely with higher performance evaluations" and whether "the effect of seniority on wages (is) independent of the presence of controls for performance evaluation." The justification for these questions comes from the fact that most of what we know on the relationship between supervisors' evaluations, seniority, promotions and wages comes from two quite influential but old papers by Medoff and Abraham (1980 and 1981; MA hereafter) whose results, albeit widely quoted and discussed, have almost never been replicated and verified with different datasets.

The wide interest for the pioneering work of MA is motivated by the fact that their evidence is not only relevant for industrial psychologists willing to understand the nature and role of supervisors' evaluations. Perhaps more importantly, their evidence is aimed at offering a test of great interest for labor economists: a test of whether a positive effect of seniority on wages reflects an increase in productivity due to firm-specific human capital investment or not.¹

In MA's work the basis for this test is the assumption that job performance ratings made by immediate supervisors are valid indicators of the relative current productivity of workers. Under this assumption, if the effect of seniority on wages were due to productivity, it should disappear after controlling for supervisors' evaluations. Furthermore, if more seniority increases the probability of a higher ranking in the distribution of wages it should also increase the probability of a higher ranking in the distribution of job performance indicators. Their finding is instead that the effect of seniority on wages is essentially independent from the presence of controls for supervisors' evaluations and that while higher seniority pushes workers up in the distribution of wages within levels it does not increase the worker's ranking in the distribution of performance ratings. They therefore conclude that the human capital theory cannot explain the effect of seniority on wages and that this effect must have different explanations.

The most prominent of the alternative explanations proposed in the literature is based on the idea that a positive correlation between seniority and wages is required by implicit employment contracts aimed at creating the proper incentives to exert effort, as for example suggested by Lazear (1979 and 1981). A similar positive correlation may also be generated by contracts aimed at protecting risk averse workers from wage changes induced by fluctuations in perceived productivity, as in Harris and Holmstrom (1982) or by sorting mechanisms as in Jovanovic (1979).²

Another potentially more disruptive possibility, that received wide attention in the last decade, is that the observed positive correlation in OLS regressions is just an artifact of the data. Abraham and Farber (1987) and Altonji and Shakotko (1987) suggest, for example, that omitted variables representing the worker, the job or the worker-employer

¹See for example Becker (1964), Mincer (1974), Mortensen (1978), Mincer and Jovanovic (1981) Brown (1989) and more recently Mincer (1997).

²For recent re-evaluations of this literature, see Carmichael (1989) and Hutchens (1989).

match might be positively correlated with lower quit rates and higher productivity. Therefore, the observed positive correlation between seniority and wages would be spurious and driven by these unobserved confounding factors. Both these papers reach the conclusion that earnings in fact do not rise very much with seniority. More recently, Topel (1991) has challenged this conclusion arguing that the two papers who propose it use inappropriate methods and/or data. On the contrary, Altonji and Williams (1997) defend and confirm the conclusion on the basis of a careful re-examination of the entire evidence.

For some scholars, the empirical question of *whether* wages do actually increase with seniority remains still open, as recently stated by Felli and Harris (1996). But, even if one were willing to accept the conservative estimates of Abraham and Farber (1987), Altonji and Shakotko (1987) and Altonji and Williams (1997), the true effect of seniority on wages would nevertheless be approximately equal to 11% per ten years.³ Even if this effect is small, it is not insignificant, and one would still like to know if it reflects an increase in productivity or other causes. Furthermore, even if firm-specific human capital investment were irrelevant and self selection of more productive workers in longer jobs were the explanation of the OLS crosssectional estimates, controls for individual productivity should still be expected to reduce this effect. For these reasons, we believe that a replication and verification of the MA results using different data is still useful and informative twenty years later.

To be more precise the goal of our paper is not only to check whether MA's results can be replicated, but also to improve and extend their testing procedure using alternative direct indicators of individual productivity. As already mentioned above, the validity of their conclusions is based on an assumption that has been widely criticized in the literature: namely that supervisors' evaluations are a good measure of individual productivity. In their papers, MA anticipate this criticism answering several possible objections and strenuously defending their assumption. But the possibility that supervisors' evaluations have little to do with individual productivity remains a potential weak point of their approach.

We think that nothing can be added to what has been already written and said in defense or against this assumption. What is instead needed is the use of other and direct measures of individual productivity in order to check whether the results obtained by MA with supervisors' evaluations continue to hold.

Our proposed additional measures of current relative productivity are indicators of absenteeism and reported misconduct episodes that can be constructed with the detailed and exhaustive information contained in our dataset. The justification for these measures is intuitive. Workers who are more often and for longer periods absent are less productive for the firm, whether or not their absenteeism is motivated by shirking or true bad health. Furthermore, inasmuch as the accumulation of firm specific human capital has to take place on the job, absenteeism must reduce such accumulation. For misconduct episodes, a higher frequency and gravity of misbehaviour recorded by the personnel office indicates lower productivity precisely from the point of view of what the personnel office considers as harmful for the firm. Neither absenteeism nor misconduct

³ This is the preferred estimate of Altonji and Williams (1997) while the Topel (1991) estimate is approximately 24% and the standard OLS estimates are in the order of 35%.

episodes fully measure productivity, but they certainly represent two important components of this multidimensional concept. It seems, therefore, likely that they should be positively correlated to the employee's true current worth for the firm. Note also that being measures of individual productivity or effort they are largely independent from aggregate shocks affecting the firm. We therefore believe that they provide interesting measures of productivity on which to check the robustness of MA's conclusions.

Our results are unambiguous: all our performance indicators do not have any effect on the seniority-wage profile and while tenure increases the worker's ranking in the distribution of wages, it actually reduces his/her ranking in the distribution of these performance indicators. Of course, the combination of ours and MA's results could still not disprove the possibility that the effect of seniority on wages reflects higher productivity of more senior workers. Suppose that productivity were the sum of two uncorrelated components: for example, *good conduct* and *knowledge*. If only the second grew with seniority our measures of *good conduct* would still leave the effect of seniority on wages unchanged. This (untestable) assumption notwithstanding, we believe that our results cast strong doubts on the hypothesis that productivity is the factor behind the growth of wages with seniority.

The paper is organized as follows: section 2 presents the data; section 3 replicates on our Italian sample the testing procedure proposed by MA; section 4 extends the original procedure using our alternative indicators of performance. Section 5 discusses possible alternative interpretations of the evidence and the conclusions that can be drawn upon it.

2 Data and Productivity Measures

The firm studied in this paper is a large bank with branches in every province of the Italian territory. From the personnel department of this bank we received several files containing, for different aspects of the employment relationship, information on all the relevant events characterizing the history of each employee of the bank. In particular the files contain information on: 1) employee's characteristics independent of time at the firm, like date and region of birth, education (level, type and grade) and previous working experience; 2) compensation levels and individual or collective wage increases and bonuses; 3) careers, promotions, job description and turnover between branches; 4) union membership and union leadership position; 5) family loads; 6) supervisors' evaluations; 7) reason and duration of absence and late arrival episodes; 8) merit, disciplinary measures and dismissals on disciplinary ground.

The information contained in these original files has been reorganized for the analysis into a panel data set with one observation per year for each worker on payroll in the month of November of each year between 1974 and 1994.⁴ To make our results comparable with the cross-sectional evidence of MA we concentrate on the sample of workers observed in the last of these years; but to construct some of our alternative productivity measures we also use the retrospective information offered by the panel structure of the

⁴See Ichino and Ichino (1997) for more details on this dataset.

data.⁵ For the same comparability, reason we limit the analysis to the male workforce.

A potentially disturbing but unavoidable difference with respect to the samples considered by MA is instead represented by the fact that we received information on supervisors' evaluations only for non-managerial workers, while MA data include also employees in managerial jobs. This difference may make the comparability between ours and MA's results less informative but it does not seem to be in anyway essential for the testing procedure or for the interpretation of our results.

Our final sample contains data on 10817 male employees on payroll during the month of November of 1994. Descriptive statistics on this sample are given in table 1. This table reports the descriptive statistics for the Company A sample described by MA. In their papers, they use data taken from three companies (A, B and C) obtaining similar results for each of them. In our paper, we decided to report, for comparison purposes, the results concerning company A because this is the company with the number of observations and the supervisors' evaluation system more similar to those of our bank. Only in the case of the auxiliary evidence presented in tables 3 and 4 we compare our bank with MA's Company B because MA do not present that type of evidence for their Company A.

Both our and MA earnings are measured before taxes but at the annual frequency in the MA firm and at the monthly frequency in our firm. As in the MA's paper, we measure education with the highest school degree attained by the worker.⁶ For workers in both firms, pre-company experience was calculated as the difference between potential working experience (computed on the basis of age and educational attainment) and seniority. Current seniority is based on the precise date in which workers took service in the firms.

Hierarchical levels for our bank were constructed following the methodology described in Baker, Gibbs and Holmstrom (1994). The idea of this procedure is to identify the relevant levels in the firm's hierarchy by looking at the actual paths followed with greatest frequency by workers in their careers. Beginning with the first level, defined as the set of positions in which workers are more frequently hired (the *port of entry*), higher levels are sequentially identified as those positions through which workers more frequently transit in a typical career. The result has been a scale of 8 grade levels for the non-managerial employees on which this paper is focused. The distribution of workers across these levels is given in table 1. Finally, table 1 describes also the regional distribution of workers in our sample.

The supervisors' evaluations system at our bank is very similar to the system that characterizes MA's firm A. Supervisors receive detailed instructions on how to rank their subordinates using a four-level scale. These instructions are analogous to those described by MA and involve four possible choices labelled as *low*, *medium*, *good* and *very good*. Table 2 shows for Italy a strong concentration of employees in the higher evaluation ranks: only 2.4% of the Italian workforce is classified in the lowest performance group,

⁵Anyway, in our dataset, supervisors' evaluations are unfortunately available only for the period 1989-94. There is no evidence that the year 1994 is different from the previous years of this short period from the point of view of the issues discussed in this paper.

⁶Post-Laurea (post-college) degrees have been introduced very recently in the Italian education system and are irrelevant in the sample considered in this paper.

while almost half of it is in the highest. Evaluation ratings are, however, more evenly distributed than in MA's company, where 74% of the workforce is concentrated in the third level. These are typical characteristic of subjective evaluation systems and have been used in the literature to argue that they cannot offer reliable measures of relative productivity because the lumping in the top category hides relevant productivity differentials. Evaluations have also been criticized as measures of productivity because supervisors are unlikely to follow uniform criteria and because irrelevant worker's characteristics might instead influence the criteria of supervisors.

If these problems exist they are certainly shared also by the system of supervisors' evaluations in use at our bank, although in this firm the more even distribution of ratings makes them somewhat less worrisome. We have nothing to add to the defense proposed by MA in their papers⁷, but we believe that the most important contribution of MA does not live or die with the reliability of supervisors' evaluations as measures of productivity. The crucial value added of their paper consists in the identification of a procedure to test whether the effect of seniority on wages reflects higher productivity of more senior workers. This procedure, originally applied using supervisors' evaluations as measures of productivity, needs now to be applied using different and more direct measures. Therefore, since our data offer this possibility, our goal is not only to show that MA's conclusions can be replicated in our firm but also and more importantly to show that they are robust with respect to other productivity indicators.

We construct these alternative indicators from the detailed information that our data set contains on the episodes of employee's absenteeism and misbehaviour recorded by the Personnel Office of our bank. As far as absenteeism is concerned, the variables that we use are constructed on the basis of the number of absence episodes per year of tenure that were due to illness and that lasted for more than 15 days.⁸ Worker's misbehavior is instead measured on the basis of the number of episodes recorded and punished by the personnel office according to the procedure established by collective bargaining and by the *Statuto dei Lavoratori*.⁹ These episodes involve unjustified absence and late arrivals, actions taken by the worker outside the relationship with the bank, but potentially relevant for the latter (e.g. fraud, theft etc.), violations of the internal regulations of the bank (e.g. omitted controls on checks, credit to unreliable customers, etc.) and inappropriate behaviour inside the workplace (e.g. sexual harassment, violence, insults, etc.). Possible punishments are chosen from a grid of sanctions established in collective bargaining that go from verbal reproaches to firing. Descriptive statistics concerning our additional performance indicators based on absenteeism and misconduct episodes are contained in table 2

To anticipate possible critiques concerning the irrelevance of supervisors' evaluations as productivity indicators, MA show that these evaluations are important predictors of the probability that a worker is promoted and of the size of wage increases. In table 3 and 4 we show that the same happens in our Italian bank. In both tables, column 1

⁷See also Bishop (1987).

⁸Shorter absence episodes are not recorded by the Personnel Office. We tried also the average duration of episodes but it did not prove relevant. Also Ichino and Ichino (1997) shows that the action in terms of absenteeism comes more from the frequency of episodes than from their duration. A careful examination of absenteeism in this firm is on our future research agenda.

⁹The *Statuto dei Lavoratori* is the chart of workers' rights that regulates the most crucial aspects of Italian industrial relations.

report the MA's estimates while columns 2 reports the analogous estimates for our firm. In both firms, and in particular in the Italian one, controlling for individual characteristics and hierarchical levels, employees receiving better evaluations are more likely to be promoted and receive higher percentage wage increases. The probability of promotion is estimated using a Logit model while an OLS regression is used to predict percentage wage increases.

In columns 3 and 4 of the same tables we show that also our alternative indicators of productivity, based on absenteeism and misbehaviour, are important predictors of promotions (table 3) and wage increases (table 4). Controlling for individual characteristics and hierarchical levels, employees who are less frequently involved in absence or misconduct episodes are more likely to be promoted and receive larger percent wage increases.

Note that for supervisors' evaluations one could argue that in these regressions causality goes in the opposite way in the sense that better evaluations are granted to justify promotions and wage increases that are previously decided on different grounds. In this case, higher evaluations would just be the bureaucratic consequence of the decision to promote or to give a wage increase. It seems instead difficult to claim that the same reverse link of causation occurs for our alternative indicators of productivity. Therefore, extending MA's procedure on the basis of measures of absenteeism or misbehaviour seems important for this reason as well. But before presenting the results of this extension, we want to show, in the next section, that MA's evidence based on supervisors' evaluations is replicated in our firm.

3 Replication: The Effect of Supervisor's Evaluations

MA's empirical analysis is based on two distinct steps. The first one consists in the estimation of $\ln(\text{earning})$ functions with or without controls for supervisors' evaluations. In these regressions they find that the coefficient of seniority remains the same independently of the presence or absence of these controls. The second step is based on a multinomial logit analysis aimed at establishing if workers who rank higher in the distribution of earnings because of seniority, have also, for the same reason, a higher ranking in the distribution of performance evaluations. In this analysis they find that while higher seniority pushes workers up in the distribution of earnings it tends to lower their position in the distribution of evaluations. In this section we replicate these two steps to check whether MA's results are confirmed in our firm.

3.1 Earning Functions

Table 5 reports comparable estimates of $\ln(\text{pre-tax earning})$ functions based on our firm and on MA's Company A.¹⁰ The models in columns 1 and 4 are based on the standard

¹⁰As already mentioned, for comparison purposes we report here the results for MA's Company A because its evaluation system is more similar to the one in use at our bank.

human capital specification of these regressions. The first set of regressors are dummies for schooling levels. Until very recently, the Italian education system did not offer master and doctorate degrees and, therefore, dummies for these degrees are not available in the Italian sample. The comparison concerning the other educational coefficients shows that, holding labor market experience constant, returns to education are substantially lower in Italy.¹¹ With respect to college degree holders (the omitted category in both samples), Italian employees experience an income loss of 18% if they have less than a highschool diploma, while similarly educated US workers lose 25%. Holding just the highschool diploma implies a loss of 5% in Italy and of 13% in the US.

The next set of regressors captures the effect of total labor market experience distinguishing between time potentially spent with previous employers and seniority in the current firm. Both these effects are captured by linear and quadratic terms. Potential previous experience has basically no effect on current wages in the Italian sample. Probably because of high firing costs in Italian large service firms¹², employees at our bank are usually hired very soon after leaving schools and careers take place within the firm as in the Internal Labor Market paradigm.¹³ In this way the firm can minimize the cost of having to keep on payroll workers that after hiring prove undesirable but too costly to fire. As a result, seniority represents more than 80% of total labor market experience for more than 50% of the workforce. We therefore believe that, as far as labor market experience is concerned, the comparison between our's and MA's results is probably interesting and meaningful only for the effect of seniority.

As far as seniority is concerned, 10 years of company service increase wages more in the Italian firm than in the US firm but the effects are similar. At ten years of seniority, ten more years of seniority increase wages by approximately 19% in Italy and by approximately 14% in the U.S.¹⁴ Therefore, in both firms more senior workers are observed to earn substantially higher wages and the question addressed by MA is whether this effect has to be attributed to productivity or to other reasons.

Since supervisors' evaluations can be interpreted as indicators of relative productivity only within hierarchical levels, MA's next step consists in estimating how much of the effects of education and experience remains holding hierarchical levels constant. Their results are presented in column 5 while the comparable Italian results are in column 2. In both countries most of the loss due to holding less than a highschool diploma instead of a college degree comes from assignment to levels with lower mean earnings. For highschool graduates, instead, the loss takes place within grade levels in Italy, but between grade levels in the US.

Coming to seniority, a significant and similar effect of company service remains in

¹¹This result complements in an important way the comparative evidence offered by Erickson and Ichino (1994) because it shows that their finding of lower educational returns in Italy are not a consequence of the use of after tax earnings. In that paper, in fact only after-tax earnings were available for Italy (compared to pre-tax earnings for the US), while here the comparisons concerns pre-tax earnings in both countries.

¹²See Ichino, Ichino and Polo, (1997).

¹³see Doeringer and Piore (1971).

¹⁴Note that, following MA, these estimates are based on a quadratic specification of the effect of tenure on wages and therefore are not directly comparable with the linear estimates generally found in the literature that we report in footnote 3.

both countries also after controlling for hierarchical levels: 44% of the return from one additional year of seniority occurs within grade level in the MA firm while 47% is the analogous figure for our bank.

If this within-level effect of seniority on wages were due to higher productivity of more senior workers, the introduction of productivity indicators should eliminate or at least reduce it. However, columns 3 and 6 show that the introduction of dummies for supervisors' evaluations leave the coefficients on seniority, as well as those on education, basically unchanged. MA interpret this result as evidence that "performance does not appear to be a mediating factor in the within-grade level positive relationship between either education or labor force experience and earnings".

3.2 Multinomial Logit Results

The second step of the MA's analysis is aimed at establishing whether seniority raises the employee's ranking not only in the distribution of wages but also in the distribution of performance evaluations. Following the MA's procedure, given the small fraction of workers who got the lowest rating, we first grouped together the two bottom evaluation levels 1 and 2. In this way we obtained three evaluation categories re-labelled respectively as *low*, *medium* and *high*.

We then created a trivariate categorization of within-level wages (*low*, *medium*, *high*) in the following way. Consider for example the first hierarchical level in which 10% of the workers receive a *low* evaluation, 50% receive a *medium* evaluation and 30% a *high* evaluation. Given these quantiles, we classified in the *low* wage category those workers in level 1 who were in the bottom 10% of their within-level wage distribution; in the *high* wage category those who were in the top 30% and in the *medium* wage category those who were in the intermediate 50% group. We then repeated the same procedure for each of the 8 hierarchical levels. In this way we obtained a trivariate classification for both performance and wages and each worker was assigned to a wage and to a performance category. If workers with higher wages have also higher performance evaluations, the two classifications should match perfectly. Indeed, the match is quite good although not perfect as shown by the fact that the correlation between the two classifications is 0.37. But the crucial question that these two classifications raise is whether the effect of seniority on assignments is the same in both. This question is relevant because if more senior workers were also more productive, higher seniority should increase not only the probability of an assignment to a higher wage category but also the probability of an assignment to a higher evaluation category.

Table 6 reports, for the two firms, multinomial logit estimates of the probability of assignment to the evaluation and wage categories. Looking first at the MA's results in columns 5, 6, 7, and 8, education, previous experience and seniority increase the probability of assignment to the two higher wage categories but reduce or leaves unchanged the probability of assignment to the two higher evaluation categories.

In the Italian firm, disregarding previous experience for the reasons outlined above, education and seniority have again different effects on the employees' position in the two classifications. Higher education increases the probability of assignment to the higher

wage categories but reduces or leaves unchanged the probability of higher performance evaluations. As far as company service is concerned, the Italian firm does not feature opposite effects of seniority on wages and evaluations, but the coefficients remains markedly different in addition to being higher than in the US firm. Seniority increases significantly the probability of a higher ranking in the distribution of wages but much less, in relative terms, the probability of a higher ranking in the distribution of performance evaluations.

The fact that both the earning function and the multinomial logit analysis for our firm confirm MA's results, strengthen the conclusion that the effect of seniority on wages does not reflect higher productivity of more senior workers. MA's result are not due to a peculiarity of their firm but can be replicated in a different firm, in different years and in a country characterized by very different labor market institutions.

However, the evidence presented in this section for the Italian firm shares with the MA's evidence the critique concerning the use of supervisors' evaluation. Therefore, in the next section we adapt the testing procedure proposed by MA to alternative direct measures of workers individual productivity.

4 Extension: Absenteeism and Misbehaviour

The alternative productivity indicators on which our analysis is based are constructed in the way described in section 2 from the detailed information that our data set contains on the episodes of employee's absenteeism and misbehaviour recorded by the personnel office of our bank. As in the previous section we examine first the evidence based on earning functions. Then we move to the evidence based on the assignment to productivity and wage categories, that, given the characteristics of our productivity indicators, will take the form of a simple logit analysis.

4.1 Earning Functions with Alternative Productivity Measures

Table 7 reports the results of the estimation of earning functions. For the reader's convenience, the first column reproduces the estimates of the basic human capital specification (augmented with hierarchical levels) presented in column 2 of table 5. Columns 2, 3 and 4 show how instead these estimates are modified by the introduction of our alternative productivity indicators, separately or together. In each specification the productivity measures are highly significant, but they leave the coefficient of the education and experience variables practically unchanged.

If anything, absenteeism appears to have a marginally greater negative effect on the seniority coefficient, but the overall picture coming out of this table basically confirms the results of section 3.1: more senior workers do not seem to earn more because they are more productive, at least as far as absenteeism and misconduct episodes are measures of productivity.

4.2 Logit Analysis with Alternative Productivity Measures

In order to adapt the MA's multinomial logit analysis to our productivity indicators we proceed as follows. In the case of misconduct episodes, the *high* productivity category is defined by the group of employees who were never reported for misconduct during their company service. Given the proportion of workers in this status for each hierarchical level, the same fraction of workers in the highest tail of the distribution of wages of each level was assigned to the *high* wage category. In the case of absenteeism we created a bivariate classification in which the *high* productivity category is defined by the group of employees who were never sick and absent from work for more than 15 days. The corresponding *high* wage category is therefore constituted by those employees who were found in the highest correspondent percentile of the distribution of wages within each level.

As in section 3.2, if seniority increases the probability of an assignment to the high wage categories it should also increase the probability of an assignment to the high productivity categories defined in terms of absenteeism and misconduct. If this were the evidence the hypothesis that the effect of seniority on wages reflect productivity differences could not be rejected.

However, table 8 shows that the evidence goes in the opposite direction. While the marginal effect of seniority on the probability of an assignment to the high productivity category is negative, the analogous effect on the probability of an assignment to the high wage category is positive. And this happens with both the indicators based on absenteeism and misbehaviour.

One could argue that this evidence does not exclude that more senior workers are worth more to the firm and therefore are paid more. But shows that this is certainly not happening because more senior workers are less often absent or less often punished for misbehaviour. Quite the opposite, more senior workers appears to be on average more prone to absence and to misconduct episodes.

5 Discussion and Conclusions

The possibility to replicate MA's results twenty years later, in a different firm and in a country characterized by different labor market institutions is a finding that in our opinion reinforces MA's original conclusion that productivity is not the driving force of the observed upward sloping wage-seniority profiles.

However, the simple replication of their empirical analysis, based on supervisors' evaluations as indicators of productivity, suffers of the same weakness of their approach: namely, that supervisors' evaluations might not measures in a satisfactory way individual relative productivity. A hopefully more interesting contribution of our work is to show that MA's results are robust to the use of alternative objective indicators of relative productivity.

Somewhat surprisingly, in their 1981 article Medoff and Abraham claim that "hard"

and “objective” measures of productivity do not dominate “soft” and “subjective” performance ratings or rankings for two main reasons. First, because it is hard to find objective measures that convincingly quantify “the true value of a worker to his or her firm”. And second because “there would have to be only one dimension relevant for assessing the employee’s true current worth or the researcher would have to know the proper set of weights or shadow prices to attach to each relevant dimension.” However, in the same paper, they show that any performance indicator P which captures current productivity, albeit with some errors should reduce the value of the coefficient of seniority in $\ln(\text{earning})$ equations. “This is true even if the performance variable which is introduced captures current productivity with error, provided only that there is some information about productivity contained in the performance variable and that the error in the performance variable is uncorrelated with experience and ability”. Of course the reduction of the coefficient on seniority should be larger the smaller the error with which the performance indicator approximates the true productivity of the worker.

We believe that indicators of absenteeism and reported misconduct episodes satisfy precisely the requirements that a performance indicator needs in order to offer a test of whether the observed effect of seniority on wages reflects productivity differentials. Workers who are more often absent are evidently less productive for the firm, whether or not their absenteeism is motivated by shirking or true bad health. Furthermore, inasmuch as the accumulation of firm specific human capital has to take place “on the job” absenteeism must reduce such accumulation. Similarly, for misconduct episodes, a higher frequency and gravity of misbehaviour recorded by the personnel office clearly indicate lower productivity. These are precisely episodes in which the personnel office considers the behaviour of an employee as harmful for the firm.

In contrast with MA’s scarce faith in the usefulness of objective indicators of productivity, we think that a collage of evidence based on both subjective and objective measures, offers more convincing arguments against the idea that the effect of seniority on wages reflects the higher productivity of more serious workers.

Nevertheless, this collage of evidence is certainly not enough to *completely* dismiss with confidence the hypothesis of a productivity driven wage-seniority profile. This because productivity is a multidimensional concept that we do not know how to measure precisely. Suppose for example that productivity were the sum of two uncorrelated components: knowledge and good conduct.¹⁵ Suppose also that knowledge grows with seniority while good conduct is independent of company service. Under these assumptions wages could grow with seniority because of the underlying unobservable increase in knowledge. Yet, proxies for good conduct like indicators of absenteeism and misconduct episodes would have no effect on the wage-seniority profile. The evidence based on our alternative measures would not mean that productivity is irrelevant for the wage-seniority profile. Note that the evidence based on supervisors’ evaluations is probably more robust with respect to this problem since evaluations are likely to reflect both knowledge and good conduct. Given the multidimensionality and unobservability of the concept of productivity, each proxy has advantages and disadvantages, and only a collage of different indicators drawn from newer and better data can provide the final answer.

¹⁵We would like to thank Robert Waldmann for attracting our attention on the implications of this hypothesis.

A related problem in the interpretation of our findings is represented by the fact that there are different ways in which productivity may be the driving force of upward sloping wage-seniority profiles in cross-sectional regressions. First of all, more senior workers may be more productive because they have invested more in firm specific human capital. But, alternatively, they may be more productive simply because less productive workers (matches) are fired (dissolved) after fewer years of company service. Since our and MA's evidence is based on cross sectional evidence it cannot say which of these two possibilities is rejected. The second hypothesis has been raised in the literature after MA's papers.¹⁶ Not surprisingly, therefore, MA interpret their evidence as evidence against the hypothesis of firm's specific human capital investment, disregarding the second possibility. But we believe that twenty years later this second possibility cannot be simply disregarded.¹⁷

This is an even more relevant issue given that the alternative indicators of performance on which this paper is based measure average individual effort along the entire career of a worker. Employees more prone to absenteeism or misconduct might be expected to be fired or to be induced to quit earlier in their careers. This should induce a selection of workers in longer jobs such that seniority should appear to be associated with a lower number of absence and misconduct episodes per year of tenure. Yet we know from table 8 that this is not happening in our sample: higher seniority is associated with more absence and misconduct episodes.

We think that this finding is the consequence of the low turnover characterizing this firm (less than 4% per year) and in particular of the insignificant number of firing or induced quits for disciplinary reasons (424 in 21 years and in a firm with employment levels ranging between 15000 and 19000). These numbers suggest that almost no selection of workers has taken place in this firm, and in particular no selection of better workers in longer jobs. This appears to be a firm in which most of the employment is for life because monopolistic rents due to government regulations are large and widely shared with workers, who therefore tend not to quit voluntarily. On the other side firing costs, particularly those due to the unavailability of legal conflicts in case of firing¹⁸, are prohibitive and reduce turnover for disciplinary reasons.

Given this situation, even if in less regulated markets it were possible that upward sloping wage-seniority profiles were due to the selection of better workers in longer jobs, this is probably not happening in the case of this Italian firm simply because almost no selection takes place and jobs are for life. Therefore, the fact that our indicators of productivity do not change the wage-seniority profile is more likely to be evidence against explanations in which greater productivity is a genuine driving force of this relationship. As suggested twenty years ago by Medoff and Abraham, alternative theories in which wages are deferred for incentive or insurance reasons are more likely to explain the observed evidence.

¹⁶In particular, as already mentioned in the introduction, by Abraham and Farber (1987) and by Altonji and Shakotko (1987).

¹⁷And the debate on it is still open, as shown by the recent reappraisal of Altonji and Williams (1997).

¹⁸See Ichino, Ichino and Polo (1997).

Table 1: Descriptive statistics of the samples used in the analysis

	Means	
	(Standard Deviations)	
	Our Sample (N=10,817)	MA Sample (N=4,788)
Month/Annual wage (Italian lira/dollar)	3,184,894 (472,792)	17,884 (3,240)
Highest level of education:		
Less than high school	0.247	0.05
High school	0.583	0.449
Laurea/Bachelor's degree	0.169	0.444
Master		0.049
Doctorate		0.007
Age (years)	40.7 (8.5)	43.1 (10.5)
Pre-company experience (years)	5 (4.6)	6.8 (6.7)
Seniority (years)	16.4 (8.3)	16.8 (10.4)
Levels:		
Ausiliari (Blue Collar)	0.011	
Commessi (Blue Collar)	0.033	
Low-Entry White Collar	0.053	
High-Entry White Collar	0.202	
White Collar (level 5)	0.127	
White Collar (level 6)	0.238	
White Collar (level 7)	0.179	
Quadro	0.156	
Regional dummies:		
North	0.631	
Centre	0.199	
South	0.170	

Note: The MA Sample is the Company A sample described in MA 1980. The distribution across levels and regions is not reported by MA

Table 2: Characteristics of the productivity measures used in the analysis

	Mean (standard deviation)	
	Our Sample (N=10,817)	MA Sample (N=4,788)
Supervisors' evaluations:		
1 = Worst	0.024	0.002
2	0.125	0.053
3	0.369	0.743
4 = Best	0.483	0.202
Our performance indicators:		
Number of absences per year of seniority	0.42 (0.57)	
Number of misconducts per year of seniority	0.01 (0.03)	
= 1 if worker was never absent	0.10 (0.30)	
= 1 if worker never misbehaved	0.89 (0.32)	

Note: The MA sample is the Company A sample described in MA 1980. Absence episodes are defined as instances in which the employee has been away from work for health related reasons and for more than 15 days. Misconduct episodes are defined as episodes of misbehaviour reported to the Personnel Office and punished by the latter according to what is established by collective bargaining and by the *Statuto dei Lavoratori*.

Table 3: Determinants of the Probability of Promotion; Logit estimates

	MA Sample (N=2,728)	Our Sample (N=10,817)		
< High School	0.09 (0.66)	-0.60 (0.17)	-0.49 (0.17)	-0.50 (0.17)
High School	-0.39 (0.23)	-0.21 (0.09)	-0.19 (0.09)	-0.21 (0.09)
Master	0.25 (0.28)			
Doctorate	-0.002 (0.49)			
Previous exper./10	-0.71 (0.32)	-0.40 (0.22)	-0.49 (0.22)	-0.48 (0.22)
(Previous exper.) ² /100	0.08 (0.11)	0.01 (0.09)	0.07 (0.09)	0.07 (0.09)
Seniority/10	-1.28 (0.30)	0.51 (0.21)	0.99 (0.21)	1.13 (0.21)
(Seniority) ² /100	0.23 (0.08)	-0.47 (0.07)	-0.61 (0.07)	-0.65 (0.07)
Evaluation = 1 or 2 (MA sample)	-0.99 (0.21)	-1.13 (0.43)		
Evaluation = 1 (our sample)				
Evaluation = 3		0.93 (0.12)		
Evaluation = 4	-0.14 (0.38)	1.30 (0.13)		
N. of absences per years of seniority		/100	-0.32 (0.07)	
N. of misconducts per years of seniority				-3.01 (1.13)
Regional dummies	Yes	Yes	Yes	Yes
Level dummies	Yes	Yes	Yes	Yes
Constant	Yes	-3.01 (0.21)	-2.11 (0.20)	-2.29 (0.19)
PseudoR ²	—	0.115	0.098	0.095

Notes: the table presents the logit coefficients, as in MA 1980, with standard errors in parenthesis. MA sample (Company B of MA 1980): dependent variable = 1 if promotion takes place between July 1, 1976 and July 1, 1977; omitted dummies: College degree and evaluations = 3 and 4. Our Sample: dependent variable = 1 if promotion takes place between November 1, 1994 and December 31, 1995; omitted dummies: Laurea and evaluation = 2.

Table 4: Determinants of the percentage wage increases; OLS estimates

	MA Sample (N=2,763)	Our Sample (N=10,623)		
< High School	0.12 (0.50)	0.72 (0.49)	1.04 (0.49)	1.05 (0.49)
High School	-0.06 (0.19)	-0.88 (0.30)	-0.70 (0.30)	-0.75 (0.30)
Master	-0.49 (0.29)			
Doctorate	-0.35 (0.50)			
Previous exper./10	-0.71 (0.29)	-0.90 (0.63)	-1.04 (0.63)	-1.01 (0.63)
(Previous exper.) ² /100	0.04 (0.10)	-0.33 (0.26)	-0.25 (0.26)	-0.26 (0.26)
Seniority/10	-1.52 (0.28)	-0.24 (0.53)	-0.43 (0.53)	0.22 (0.53)
(Seniority) ² /100	0.26 (0.08)	0.08 (0.13)	0.11 (0.13)	-0.03 (0.13)
ln(annual wage) at $t - 1$	-8.30 (0.80)	-25.27 (1.11)	-24.80 (1.11)	-23.99 (1.10)
Evaluation = 1	-2.88 (0.68)	-2.99 (0.75)		
Evaluation = 2	-1.74 (0.16)			
Evaluation = 3		1.52 (0.33)		
Evaluation = 4	0.99 (0.38)	2.09 (0.35)		
N. of absences per year of seniority			-1.36 (0.19)	
N. of misconducts per year of seniority				-15.35 (2.93)
Regional dummies	Yes	Yes	Yes	Yes
Level dummies	Yes	Yes	Yes	Yes
Constant	Yes	467.10 (19.76)	460.88 (19.74)	445.56 (19.56)
R ²	0.147	0.068	0.065	0.063

Notes: MA sample (Company B of MA 1980): Dependent variable = Percentage wage change between 1977 and 1976; omitted dummies: College degree and evaluation = 3. Our Sample: Percentage wage change between 1995 and 1994; omitted dummies: Laurea and evaluation = 2. Standard errors in parentheses.

- [17] Hutchens R.M. (1989), "Seniority, Wages and Productivity: a Turbulent Decade", *The Journal of Economic Perspectives*, 3, 49-64.
- [18] Lazear E. (1979), "Why is there Mandatory Retirement?", *Journal of Political Economy*, 87, 1261-84.
- [19] Lazear E. (1981), "Agency, Earnings Profiles, Productivity and Hours Restrictions", *American Economic Review*, 71, 606-720.
- [20] Medoff J., and K. Abraham (1980), "Experience, Performance, and Earnings", *Quarterly Journal of Economics*, December.
- [21] Medoff J., and K. Abraham (1981), "Are Those Paid More Really More Productive? The Case of Experience", *The Journal of Human Resources*, V. 15, No. 2.
- [22] Mincer J. (1974), *Schooling, Experience, and Earnings*, New York: NBER.
- [23] Mincer J. (1997), "The Production of Human Capital and the Life Cycle of Earnings: Variations on a Theme", *Journal of Labor Economics*, V. 15, No. 1, Pt. 2.
- [24] Mincer J., and B. Jovanovic (1981), "Labor Mobility and Wages", in S. Rosen (ed.), "Studies in Labor Market", NBER Universities-National Bureau Conference Series, No. 31, Chicago: University of Chicago Press, 1981, 21-64.
- [25] Mortensen D. (1978), "Specific Capital and Labor Turnover", *Bell Journal of Economics*, Autumn 1978, 9, 572-86.
- [26] Topel R. (1991), "Specific Capital, Mobility, and Wages: Wages Rise with Job Seniority", *Journal of Political Economy*, V. 99, No. 1.

References

- [1] Abraham K., and H. Farber (1987), "Job Duration, Seniority, and Earnings", *American Economic Review*, V. 77, No. 3.
- [2] Altonji J., and R. Shakotko (1987), "Do Wages Rise with Job Seniority?", *Review of Economic Studies*, V. 54, pp. 437-459.
- [3] Altonji J., and N. Williams (1997), "Do Wages Rise with Job Seniority? A Re-assessment", *NBER Working Paper*, No. 6010.
- [4] Becker G. (1964), *Human capital: a theoretical analysis with special reference to education*, New York: Columbia University Press for NBER.
- [5] Baker G., M. Gibbs, and B. Holmstrom (1994), "The Internal Economics of the Firm: Evidence from Personnel Data", *Quarterly Journal of Economics*, V. 59, pp. 881-919.
- [6] Bishop J. (1987), "The Recognition and Reward of Employee Performance", *Journal of Labor Economics*, V. 5, No. 4, Pt. 2.
- [7] Brown J. (1989), "Why Do Wages Increase with Tenure? On-the-Job Training and Life-Cycle Wage Growth Observed Within Firms", *American Economic Review*, V. 79, No. 5.
- [8] Carmichael H.L. (1989), "Self Enforcing Contracts, Shirking and Life Cycle Incentives", *The Journal of Economic Perspectives*, 3, 65-84.
- [9] Doeringer P.B., and M.J. Piore (1971), *Internal Labor Market and Manpower Analysis*, Lexington, Mass.: D.C. Heath and Co.
- [10] Erickson C., and A. Ichino (1994), "Wage Differentials in Italy: Market Forces, Institutions and Inflation", in R. Freeman and L. Katz, *Differences and Changes in the Wage Structure*, NBER, University of Chicago Press, 1995, pp. 265-305.
- [11] Felli L., and C. Harris (1996), "Learning, Wage Dynamics, and Firm-Specific Human Capital", *Journal of Political Economy*, V. 104, No. 4.
- [12] Gibbons R. (1996), "Incentives and Careers in Organizations", NBER WP n. 5705.
- [13] Ichino A., and P. Ichino (1997), "Culture, Discrimination and Individual Productivity. Regional Evidence from Personnel Data in a Large Italian Firm", CEPR Working Paper 1709.
- [14] Ichino A., P. Ichino, and M. Polo (1997), "Are Judges Biased by Labor Market Conditions? The Selection of Firing Litigations for Trial in a Large Italian Firm", IGER mimeo.
- [15] Jovanovic B. (1979), "Job Matching and the Theory of Turnover", *Journal of Political Economy*, 87, 973-90.
- [16] Harris M., and B. Holmstrom (1982), "A Theory of Wage Dynamics", *Review of Economic Studies*, XLIX, 315-333.

Table 5: Earning functions; OLS estimates

Model:	Our Sample			MA Sample		
	1	2	3	4	5	6
N. obs:	10817	10817	10817	4788	4788	4788
< High School	-0.18 (0.004)	-0.04 (0.003)	-0.04 (0.003)	-0.25 (0.01)	-0.08 (0.007)	-0.08 (0.007)
High School	-0.05 (0.003)	-0.04 (0.002)	-0.04 (0.002)	-0.13 (0.005)	-0.01 (0.003)	-0.02 (0.003)
Master				0.10 (0.01)	0.02 (0.006)	0.02 (0.006)
Doctorate				0.21 (0.025)	0.05 (0.016)	0.05 (0.016)
Previous exper./10	0.00 (0.006)	-0.01 (0.004)	0.00 (0.004)	0.04 (0.008)	0.02 (0.005)	0.03 (0.005)
(Previous exper.) ² /100	-0.01 (0.002)	0.00 (0.002)	0.00 (0.002)	-0.00 (0.003)	-0.00 (0.002)	-0.00 (0.002)
Seniority/10	0.25 (0.004)	0.13 (0.003)	0.12 (0.003)	0.20 (0.008)	0.09 (0.006)	0.09 (0.006)
(Seniority) ² /100	-0.03 (0.001)	-0.02 (0.001)	-0.01 (0.001)	-0.03 (0.002)	-0.01 (0.001)	-0.01 (0.001)
Evaluation = 1			-0.16 (0.004)			-0.05 (0.027)
Evaluation = 2						-0.04 (0.006)
Evaluation = 3			0.022 (0.002)			
Evaluation = 4			0.029 (0.002)			0.03 (0.003)
Regional dummies	Yes	Yes	Yes	Yes	Yes	Yes
Level dummies		Yes	Yes		Yes	Yes
Constant	14.75 (0.004)	15.00 (0.003)	14.98 (0.004)	Yes —	Yes —	Yes —
R ²	0.648	0.856	0.86	0.356	0.741	0.747

Note: the dependent variable is the log of pre-tax annual earnings for both firms; the omitted dummies in our sample are: Laurea and Evaluation = 2; the omitted dummies in MA's sample are: College degree and Evaluation = 3; the MA sample is Company A sample in MA 1980; standard errors are in parentheses.

Table 6: Assignment to performance and wage categories; multinomial logit estimates

Model:	Our Sample				MA sample			
	10817		10817		4784		4784	
N. obs:	Performance		Wage		Performance		Wage	
Depvar:	Medium	High	Medium	High	Medium	High	Medium	High
< High School	0.32 (0.17)	1.34 (0.17)	-1.51 (0.26)	-3.53 (0.29)	0.21 (0.31)	0.50 (0.37)	-2.54 (0.29)	-3.04 (0.34)
High School	-0.08 (0.09)	0.29 (0.10)	-1.89 (0.13)	-3.29 (0.15)	0.23 (0.17)	0.47 (0.18)	-0.58 (0.19)	-0.57 (0.20)
Master or Phd					0.11 (0.35)	0.24 (0.36)	1.16 (0.47)	1.65 (0.49)
Previous exper. /10	-0.53 (0.23)	-0.80 (0.23)	-0.34 (0.28)	-0.57 (0.32)	-0.81 (0.27)	-1.32 (0.29)	0.44 (0.27)	0.83 (0.29)
(Previous exper.) ² /100	0.27 (0.10)	0.51 (0.10)	0.17 (0.12)	0.26 (0.13)	0.20 (0.10)	0.27 (0.11)	-0.07 (0.09)	-0.08 (0.11)
Seniority/10	1.78 (0.16)	2.61 (0.17)	10.74 (0.41)	7.99 (0.45)	0.43 (0.26)	-0.12 (0.29)	1.12 (0.28)	2.90 (0.32)
(Seniority) ² /100	-0.49 (0.04)	-0.57 (0.04)	-2.67 (0.14)	-0.49 (0.16)	-0.13 (0.06)	-0.06 (0.07)	-0.13 (0.07)	-0.41 (0.08)
Regional dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Level dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Constant	1.42 (0.26)	1.35 (0.27)	-3.10 (0.34)	-2.42 (0.37)	Yes	Yes	Yes	Yes
PseudoR ²	0.161		0.469		-	-	-	-

Note: The dependent variables are the trivariate performance and wage classifications. The omitted category for both classifications is the lowest one. The college degree is the omitted education dummy. The MA's sample is the Company A sample in MA 1980; standard errors in parentheses.

Table 7: Earning functions with alternative productivity measures; OLS estimates

Model :	1	2	3	4
N. obs:	10817	10817	10817	10817
< High School	-0.04 (0.003)	-0.04 (0.003)	-0.04 (0.003)	-0.04 (0.003)
High School	-0.04 (0.002)	-0.04 (0.002)	-0.04 (0.002)	-0.04 (0.002)
Previous exper./10	-0.01 (0.004)	0.00 (0.004)	0.00 (0.004)	0.00 (0.004)
(Previous exper.) ² /100	0.00 (0.002)	0.00 (0.002)	0.00 (0.002)	0.00 (0.002)
Seniority/10	0.13 (0.003)	0.12 (0.003)	0.13 (0.003)	0.12 (0.003)
(Seniority) ² /100	-0.02 (0.001)	-0.01 (0.001)	-0.02 (0.001)	-0.01 (0.001)
N. of absences per year of seniority		-0.02 (0.002)		-0.01 (0.002)
(N. of absences per year of seniority) ²		0.001 (0.000)		0.001 (0.000)
N. of misconducts per year of seniority			-0.08 (0.03)	-0.03 (0.03)
(N. of misconducts per year of seniority) ²			-0.19 (0.08)	-0.20 (0.08)
Evaluation = 1				-0.01 (0.004)
Evaluation = 3				0.02 (0.002)
Evaluation = 4				0.03 (0.002)
Regional dummies	Yes	Yes	Yes	Yes
Level dummies	Yes	Yes	Yes	Yes
Constant	15.00 (0.003)	15.01 (0.003)	15.00 (0.003)	14.99 (0.004)
R ²	0.856	0.858	0.857	0.861

Note: The dependent variable is the log of pre-tax annual earnings. Omitted dummies: Laurea and Evaluation = 2. Absence episodes are defined as instances in which the employee has been away from work for health related reasons and for more than 15 days. Misconduct episodes are defined as episodes of misbehaviour reported to the Personnel Office and punished by the latter according to what is established by collective bargaining and by the *Statuto dei Lavoratori*. Standard errors in parentheses.

Table 8: Assignment to performance and wage categories with alternative productivity measures; Logit estimates

Model:	1		2	
N. obs:	10817		10817	
	Misconduct		Absence	
Dependent variable:	performance	wage	performance	wage
< High School	0.00 (0.01)	-0.04 (0.01)	0.00 (0.01)	-0.10 (0.01)
High School	-0.03 (0.01)	-0.04 (0.00)	-0.01 (0.01)	-0.05 (0.00)
Previous exper./10	-0.05 (0.02)	0.00 (0.01)	-0.01 (0.02)	0.00 (0.01)
(Previous exper.) ² /100	0.03 (0.01)	0.00 (0.00)	0.01 (0.01)	0.00 (0.00)
Seniority/10	-0.14 (0.01)	0.12 (0.01)	-0.18 (0.01)	0.14 (0.01)
(Seniority) ² /100	0.02 (0.00)	-0.01 (0.00)	0.04 (0.00)	-0.01 (0.00)
Regional dummies	Yes	Yes	Yes	Yes
Level dummies	Yes	Yes	Yes	Yes
Constant	0.43 (0.02)	-0.07 (0.01)	0.03 (0.01)	-0.32 (0.01)
PseudoR ²	0.09	0.368	0.091	0.248

Notes: The table reports marginal effects with standard errors in parentheses. For misconduct episodes: performance dependent variable = 1 if worker never misbehaved (mean = 0.89); wage dependent variable = 1 if wage is in the high category (see text; mean = 0.88). For absence episodes: performance dependent variable = 1 if worker never absent for more than 15 days (mean = 0.10); wage dependent variable = 1 if wage is in the high category (see text; mean = 0.09). Absence episodes are defined as instances in which the employee has been away from work for health related reasons and for more than 15 days. Misconduct episodes are defined as episodes of misbehaviour reported to the Personnel Office and punished by the latter according to what is established by collective bargaining and by the *Statuto dei Lavoratori*.



EUI WORKING PAPERS

EUI Working Papers are published and distributed by the
European University Institute, Florence

Copies can be obtained free of charge
– depending on the availability of stocks – from:

The Publications Officer
European University Institute
Badia Fiesolana
I-50016 San Domenico di Fiesole (FI)
Italy

Please use order form overleaf

Publications of the European University Institute

To The Publications Officer
 European University Institute
 Badia Fiesolana
 I-50016 San Domenico di Fiesole (FI) – Italy
 Telefax No: +39/55/4685 636
 e-mail: publish@datacomm.iue.it
 <http://www.iue.it>

From Name

 Address

- Please send me a complete list of EUI Working Papers
- Please send me a complete list of EUI book publications
- Please send me the EUI brochure Academic Year 1998/99

Please send me the following EUI Working Paper(s):

No, Author

Title:

No, Author

Title:

No, Author

Title:

No, Author

Title:

Date

Signature

**Working Papers of the Department of Economics
Published since 1997**

ECO No. 97/1

Jonathan SIMON
The Expected Value of Lotto when not all
Numbers are Equal

ECO No. 97/2

Bernhard WINKLER
Of Sticks and Carrots: Incentives and the
Maastricht Road to EMU

ECO No. 97/3

James DOW/Rohit RAHI
Informed Trading, Investment, and
Welfare

ECO No. 97/4

Sandrine LABORY
Signalling Aspects of Managers'
Incentives

ECO No. 97/5

Humberto LÓPEZ/Eva ORTEGA/Angel
UBIDE
Dating and Forecasting the Spanish
Business Cycle

ECO No. 97/6

Yadira GONZÁLEZ de LARA
Changes in Information and Optimal Debt
Contracts: The Sea Loan

ECO No. 97/7

Sandrine LABORY
Organisational Dimensions of Innovation

ECO No. 97/8

Sandrine LABORY
Firm Structure and Market Structure: A
Case Study of the Car Industry

ECO No. 97/9

Elena BARDASI/Chiara MONFARDINI
The Choice of the Working Sector in
Italy: A Trivariate Probit Analysis

ECO No. 97/10

Bernhard WINKLER
Coordinating European Monetary Union

ECO No. 97/11

Alessandra PELLONI/Robert
WALDMANN
Stability Properties in a Growth Model

ECO No. 97/12

Alessandra PELLONI/Robert
WALDMANN
Can Waste Improve Welfare?

ECO No. 97/13

Christian DUSTMANN/Arthur van
SOEST
Public and Private Sector Wages of Male
Workers in Germany

ECO No. 97/14

Søren JOHANSEN
Mathematical and Statistical Modelling of
Cointegration

ECO No. 97/15

Tom ENGSTED/Søren JOHANSEN
Granger's Representation Theorem and
Multicointegration

ECO No. 97/16

Søren JOHANSEN/
Ernst SCHAUMBURG
Likelihood Analysis of Seasonal
Cointegration

ECO No. 97/17

Maozu LU/Grayham E. MIZON
Mutual Encompassing and Model
Equivalence

ECO No. 97/18

Dimitrios SIDERIS
Multilateral Versus Bilateral Testing for
Long Run Purchasing Power Parity: A
Cointegration Analysis for the Greek
Drachma

ECO No. 97/19

Bruno VERSAEVEL
Production and Organizational
Capabilities

ECO No. 97/20

Chiara MONFARDINI
An Application of Cox's Non-Nested
Test to Trinomial Logit and Probit
Models

ECO No. 97/21

James DOW/Rohit RAHI
Should Speculators be Taxed?

*out of print

ECO No. 97/22
Kitty STEWART
Are Intergovernmental Transfers in
Russia Equalizing?

ECO No. 97/23
Paolo VITALE
Speculative Noise Trading and
Manipulation in the Foreign Exchange
Market

ECO No. 97/24
Günther REHME
Economic Growth, (Re-)Distributive
Policies, Capital Mobility and Tax
Competition in Open Economies

ECO No. 97/25
Susana GARCIA CERVERO
A Historical Approach to American Skill
Differentials

ECO No. 97/26
Susana GARCIA CERVERO
Growth, Technology and Inequality: An
Industrial Approach

ECO No. 97/27
Bauke VISSER
Organizational Structure and Performance

ECO No. 97/28
Pompeo DELLA POSTA
Central Bank Independence and Public
Debt Convergence in an Open Economy
Dynamic Game

ECO No. 97/29
Matthias BRUECKNER
Voting and Decisions in the ECB

ECO No. 97/30
Massimiliano MARCELLINO
Temporal Disaggregation, Missing
Observations, Outliers, and Forecasting:
A Unifying Non-Model Based Procedure

ECO No. 97/31
Marion KOHLER
Bloc Formation in International Monetary
Policy Coordination

ECO No. 97/32
Marion KOHLER
Trade Blocs and Currency Blocs: A
Package Deal?

ECO No. 97/33
Lavan MAHADEVA
The Comparative Static Effects of Many
Changes

ECO No. 97/34
Lavan MAHADEVA
Endogenous Growth with a Declining
Rate of Interest

ECO No. 97/35
Spyros VASSILAKIS
Managing Design Complexity to Improve
on Cost, Quality, Variety, and Time-to-
Market Performance Variables

ECO No. 97/36
Spyros SKOURAS
Analysing Technical Analysis

ECO No. 98/1
Bauke VISSER
Binary Decision Structures and the
Required Detail of Information

ECO No. 98/2
Michael ARTIS/Massimiliano
MARCELLINO
Fiscal Solvency and Fiscal Forecasting in
Europe

ECO No. 98/3
Giampiero M. GALLO/Barbara PACINI
Early News is Good News: The Effects
of Market Opening on Market Volatility

ECO No. 98/4
Michael J. ARTIS/Zenon G.
KONTOLEMIS
Inflation Targeting and the European
Central Bank

ECO No. 98/5
Alexandre KOLEV
The Distribution of Enterprise Benefits in
Russia and their Impact on Individuals'
Well-Being

ECO No. 98/6
Kitty STEWART
Financing Education at the Local Level: A
Study of the Russian Region of
Novgorod

*out of print

ECO No. 98/7

Anna PETTINI/Louis PHILIPS
A Redistributive Approach to Price and
Quality Discrimination

ECO No. 98/8

Aldo RUSTICHINI/Andrea
ICHINO/Daniele CHECCHI
More Equal but Less Mobile? Education
Financing and Intergenerational Mobility
in Italy and in the US

ECO No. 98/9

Andrea ICHINO/Pietro ICHINO
Discrimination or Individual Effort?
Regional Productivity Differentials in a
Large Italian Firm

ECO No. 98/10

Andrea ICHINO/Rudolf WINTER-
EBMER
The Long-Run Educational Cost of
World War II. An Example of Local
Average Treatment Effect Estimation

ECO No. 98/11

Luca FLABBI/Andrea ICHINO
Productivity, Seniority and Wages. New
Evidence from Personnel Data

*out of print



