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Institut de Recerca en Economia Aplicada Regional i Públic
*Research Institute of Applied Economics*

WEBSITE: www.ub-irea.com • CONTACT: irea@ub.edu

Grup de Recerca Anàlisi Quantitativa Regional
*Regional Quantitative Analysis Research Group*

WEBSITE: www.ub.edu/aqr/ • CONTACT: aqr@ub.edu

**Universitat de Barcelona**
Av. Diagonal, 690 • 08034 Barcelona

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# What Drives the Urban Wage Premium? Evidence along the Wage Distribution

**Alessia Matano*** **and Paolo Naticchioni†**

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**Abstract**

This paper aims at disentangling the role played by different theoretical explanations in accounting for the urban wage premium along the wage distribution. We analyze the wage dynamics of migrants from low-to-high-density areas in Italy, using quantile regression and individual panel data to control for the sorting of workers. The results show that skilled workers enjoy a higher wage premium when they migrate (wage level effect), in line with the agglomeration externalities explanation, while unskilled workers benefit more from a wage premium accruing over time (wage growth effect). Further, investigating the determinants of the wage growth effect in greater depth, we find that for unskilled workers the wage growth is mainly due to human capital accumulation over time, consistently with the "learning" hypothesis, while for skilled workers it is the "coordination" hypothesis that matters.

JEL Classification: J31, J61, R23.

Keywords: Urban Wage Premium, Human Capital, Spatial Sorting, Wage Distribution, Quantile Fixed Effects.

* Alessia Matano, University of Barcelona UB, AQR-IREA, University of Rome "La Sapienza", Dipartimento di Analisi Economiche e Sociali. Email: amatano@ub.edu.

† Paolo Naticchioni, University of Cassino, University of Rome "La Sapienza", CeLEG-Luiss. Email: p.naticchioni@gmail.com.

## 1. Introduction

The existence and extent of the urban wage premium have been widely investigated in the spatial economic literature, and various different theories have been proposed. The most widely accepted explanation refers to urbanization externalities in terms of reduced transport costs, technology and knowledge spillovers, cheaper inputs and proximity to consumers (Glaeser, 1998, Kim, 1987, Ciccone and Hall, 1996). According to this theoretical framework, workers moving to cities should immediately experience wage level increases, while those leaving cities should experience wage losses (wage level effect). More recently, a "learning" explanation has been proposed, i.e. in cities human capital accumulation is faster (Moretti, 2004). In this framework, workers moving to cities will only experience wage increases over time (wage growth effect), while those leaving cities will not necessarily suffer wage losses. Another explanation that entails the possibility of a wage growth effect being generated is the "coordination" hypothesis, since cities enhance the probability of a better match between workers and firms, and this probability increases with the time spent in cities (Kim, 1990, Yankow 2006). Furthermore, the literature has also pointed out the importance of controlling for the sorting of workers, since the urban wage premium could be the outcome, at least partially, of skilled workers being sorted into cities (Combes et al. 2008, Mion and Naticchioni, 2009, Matano and Naticchioni, 2011).

From the empirical point of view, the first paper that discussed and tested the role played by the different explanations is Glaeser and Marè (2001), which analyzes the determinants of the urban wage premium in the US using data from the National Longitudinal Survey of Youth (NLSY), the Panel Study of Income Dynamics (PSID) and the 1990 US census. In particular, the authors analyze the

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migration flows from rural-to-urban areas (and vice versa), in order to disentangle the wage growth effect from the wage level effect. Glaeser and Marè (2001) also perform fixed effects estimates to control for the sorting of workers. Their results show that a non-negligible part of the urban wage premium accrues to workers over time and is retained when they leave cities, consistently with the wage growth explanation. Nonetheless, the authors also find evidence of the wage level effect.

More recently, other papers have extended the analysis of Glaeser and Marè (2001) to investigate further the determinants of wage growth in cities, focusing on the within- and between-jobs wage growth components which represent a proxy of the "learning" and "coordination" hypothesis (Yankow, 2006, Wheeler, 2006, Baum-Snow and Pavan, 2011).

The original contribution offered by this paper lies in extending to the whole wage distribution the analysis of the role played by the different theoretical explanations in accounting for the urban wage premium, which represents an unexplored field of research in the spatial economic literature, to the best of our knowledge.

We make use of the Italian employer-employee INPS (the Italian Social Security Institute) database, from 1986-2003. In the first part of the paper we analyze the wage dynamics of migrants from low-to-high- and high-to-low-density provinces, by means of a quantile regression approach. Moreover, since previous empirical studies showed that the sorting of workers captures a significant part of the impact of spatial externalities on wages, both at the conditional mean (Combes et al. 2008, Mion and Naticchioni, 2009) and along the wage distribution (Matano and Naticchioni, 2011), the analysis takes into account the workers' unobserved heterogeneity by carrying out quantile fixed-effect estimations.

Our analysis shows that for skilled workers, i.e. those at the $90^{th}$ percentile of the wage distribution, most of the urban wage premium accrues immediately after moving from a low- to a high-density province, consistently with the wage level effect, while for unskilled workers, i.e. those at the $10^{th}$ percentile, the wage premium takes place mainly over time, consistently with the wage growth level effect.

Since our analysis suggests that the wage growth effect plays a role for both skilled and unskilled workers, in the second part of the paper we focus on the drivers of the wage growth effect, i.e. on disentangling the "learning" from the "coordination" explanation. We consider the sample of migrants from low-to-high-density provinces after migration, using quantile fixed effects regressions. As a proxy for between-jobs wage growth we use the job-change dummy (as in Baum Snow and Pavan, 2011), while as a proxy for within-job wage growth we use the job tenure variable (Topel, 1991). Once controlled for sorting, our findings show that skilled workers benefit more from better matching opportunities in cities, enjoying greater returns to job changes. As for unskilled workers, they benefit more from higher human capital accumulation, i.e. greater returns to tenure, once in cities. Similar results are derived using the sample of 'stayers' in low- and high-density provinces. This suggests that the wage dynamics detected for the migrants can be extended to different groups of workers in the economy, thereby reassuring about the possible endogeneity of the migration choices.

Our results clearly bring out the importance of investigating the determinants of the urban wage premium along the wage distribution, since the relevance of the different explanations differs between skilled and unskilled workers. Further, it is also worth stressing that taking into account the whole wage distribution affords new insights that prove more revealing than when conventional measures of skills are applied, such as educational levels.[1]

The structure of the paper is as follows. In Section 2 we review the theoretical and empirical literature on the urban wage premium. In Section 3, we describe the data, define the spatial variable and present some descriptive statistic while Section 4 sets out the empirical analysis and discusses the main results. The conclusions are drawn in Section 5.

[1] For instance, according to the 1996 data of the European Community Household Panel, almost 50% of Italian graduates were not employed in the top quartile of the wage distribution, and around 20% had a wage lower than the median. This suggests a substantial heterogeneity across graduates, and in general for all educational levels, heterogeneity that can be better detected by investigating the whole wage distribution.

## 2. Related Literature

The urban wage premium has always been a core issue in spatial economic literature, at both the theoretical and empirical level. From the theoretical point of view, the different explanations can be summarized in the following categories: agglomeration economies, i.e. gains in productivity and reduced costs for firms located in areas of dense economic activity due to lower transportation costs, lower inputs costs, knowledge and technology spillovers between firms, proximity to consumers, etc. (Ciccone and Hall, 1996, Kim, 1987, Glaeser, 1998); the "learning" mechanism, i.e. cities enhance the accumulation of human capital because of, for instance, face-to-face interactions, particularly among skilled people whose presence is more concentrated in cities (Glaeser, 1999, Moretti, 2004, Glaeser and Resseger, 2010); the "coordination" hypothesis, i.e. urban density facilitates the matching between workers and firms because of a higher rate of job openings, which increases the probability of receiving a better offer – a probability that increases with the time spent in a dense region (Kim, 1990, Helsey and Strange, 1990).

All these explanations can potentially play a role in generating the urban wage premium. However, the timing of the urban wage premium differs across explanations. In fact, agglomeration economies imply that workers who migrate from non-urban to urban areas should enjoy an immediate wage premium (wage level effect), while the "learning" and "coordination" hypotheses imply that essentially wages in cities increase with time spent in the cities (wage growth effect).

Moreover, the literature has shown that to investigate the extent of wage level and wage growth effects properly it is crucial to control for the sorting of high ability workers into cities, i.e. skilled workers are attracted by cities, and cities make them more productive (Combes et al., 2008, Mion and Naticchioni, 2009, Matano and Naticchioni, 2011, Bacolod, Blum and Strange, 2009).

At the empirical level, the seminal paper is Glaeser and Marè (2001), which makes use of US data (1990 census, NLSY and PSID) to analyze the migration flows from rural-to-urban areas (and vice versa), in order to distinguish the wage growth

effect (essentially interpreted as evidence of human capital accumulation) from the wage level effect (agglomeration economies). The authors' research hypothesis is that if the wage growth mechanism alone were at work, workers moving to cities would only experience wage growth over time, and would not necessarily suffer wage losses when leaving cities. On the other hand, if the wage level effect applied, migrants would experience both immediate wage increases after moving to cities and wage losses when leaving them. They also perform fixed effects estimates to control for the sorting of workers. Their findings show that, apart from the wage level effect already emphasized in the literature, the wage growth effect plays an important role, which lends support to an explanation in terms of human capital accumulation.

Also Lehmer and Moller (2010) analyze the determinants of the urban wage premium in terms of wage level and wage growth effects. They analyze the case of Germany using a random sample extracted from the Employment Statistics of the Institute for Employment Research (IAB-REG). Their results confirm the existence of a sizeable urban wage premium, which is reduced when controlling for firm size, suggesting that interregional firm-size differences account for a significant part of the urban wage premium. They also point out that the urban wage premium is due more to a wage growth effect related to human capital accumulation than to a wage level effect, especially for more experienced workers.

Other related papers have investigated further the main finding emphasized by Glaeser and Maré (2001), i.e. the wage growth effect and its determinants. Using the NLSY data, Wheeler (2006) focuses on wage growth within and between cities in the US. His findings show that, on average, wage growth tends to be positively associated with the size of the local market (in terms of resident population, population density and industrial diversity). Further, Wheeler (2006) is interested in disentangling the role of within-job wage growth, which proxies the "learning" mechanism, from that of between-jobs wage growth, which proxies the "coordination" effect. He points out that faster wage growth is related to job changes rather than within-job wage growth. These findings highlight the fact that

cities enhance worker productivity mainly through a process of better matching between workers and firms taking place over time.

Also Yankow (2006) makes use of the NLSY data to show that in the US the urban wage premium is due to both wage level and wage growth effects. He then analyzes the wage growth related to the between-jobs dynamics in order to shed some light on the relevance of the "coordination" hypothesis. He shows that there is no statistical difference between urban and non-urban workers in the average wage gain from a single job change. However, he finds evidence that in cities there is a significantly higher frequency of job changes, entailing a higher cumulative wage growth related to job changes.

Finally, Baum-Snow and Pavan (2011) decompose the city size wage premium into its various components using the NLSY data for the US. In particular, they develop a structural on-the-job-search model that includes all the relevant explanations that affect the urban wage premium (unobserved ability, search frictions, quality job matching between workers and firms, human capital accumulation and endogenous migration). They investigate the role played by these different explanations in small, medium and large cities, finding out that human capital accumulation is more important for generating wage premiums among large and small cities, while wage level effects are more important among medium and small sized cities. In contrast with Wheeler (2006), they claim that better matching plays only a minor role in affecting the urban wage premium, as well as unobserved heterogeneity.[2]

All these studies focus on the analysis of the determinants of the urban wage premium evaluated at the conditional mean. The original contribution of this paper is to extend the analysis along the whole wage distribution. Some papers have already focused on related, but different, distributional/inequality issues. Wheeler

[2] Two additional papers can be considered in relation to our analysis. Bleakley and Lin (2007) show that one source of the urban wage premium is the difference in the matching opportunities between workers residing in cities and those in rural areas. Gould (2007) focuses on identification of the causal urban wage premium and develops a structural model that accounts for the self-selection of workers moving into cities, showing that cities have no urban wage premium to offer to blue-collar workers, while they see the white-collar workers' productivity enhanced. For an in-depth survey on urban wage premium and human capital externalities see Heuermann et al. (2010).

(2004) uses aggregate data for the US to show that urban density entails a decrease in wage inequality. For Germany, Moller and Haas (2003) use a quasi-quantile regression approach to evaluate the relationship between density and wage differentials at different percentiles of the wage distribution, pointing out that density increases wage inequality. While Wheeler (2004) and Moller and Haas (2003) make use of aggregate data, Matano and Naticchioni (2011) use individual level data for Italy to show that both density and specialization contribute to increasing wage inequality, after controlling for the sorting of workers. None of these studies, however, investigate the determinants and the underlying explanations of the urban wage premium along the wage distribution, which is in fact the focus of this paper.

## 3. Data Description

We use a panel version of the Italian administrative database provided by INPS and elaborated by ISFOL (the Italian Institute for the Development of Vocational Training).[3] It is an employer-employee dataset, constructed for the period 1986-2003 by merging the INPS employee information with the INPS employer information database.[4] The units of the analysis are industrial- (manufacturing and mining) and service-dependent workers, both part-time (converted into full-time equivalent) and full-time. We focus on standard labor contracts, including both blue and white collars. Moreover, we take into account prime-age male workers as in Glaeser and Maré (2001) and Mion and Naticchioni (2009), among others. In particular, we

[3] The sample scheme of the database follows individuals born on the 10$^{th}$ of March, June, September and December and therefore the proportion of this sample in the Italian employee population is approximately of 1/90. The panel version was constructed considering only one observation per year for each worker. For those workers who have more than one observation per year we selected the longest contract in terms of weeks worked. We also eliminated the observations below (above) the 0.5$^{th}$ (99.5$^{th}$) percentile of the wage distribution.

[4] For the information on employers we also make use of the ASIA ("Italian Statistical Archive of Operating Firms") database, provided by ISTAT (the Italian National Institute of Statistics). This database has been used since 1999, because the INPS employer database was no longer available after 1998. The two databases provide the same set of information (firm size and sector).

focus on individuals aged between 25 and 49 (when they first enter the database).[5] Further, we consider only those workers that are in the dataset for at least three years, in order to get more reliable within estimations.[6] By doing so, we eventually have an unbalanced panel of 46,822 workers for 457,800 observations. As for worker characteristics, the database contains individual information such as age, gender, occupation, workplace, worker status (part-time or full-time), real gross yearly wage and the number of months, weeks and days worked. For firms, we have the plant location (province), the size (number of employees), and the sector.

We merge the INPS dataset with provincial data on industrial and service employment provided by INPS for the period 1986-2003 – our period of analysis. Using this latter database, we can define the employment density, which represents the proxy for urban agglomeration. It is defined as in Combes (2000), Ciccone and Hall (1996), Mion and Naticchioni (2009) and Matano and Naticchioni (2011): employment in province $p$ at time $t$ out of the province area in square km. The spatial breakdown is hence given by the province (*provincia*), classified in 95 units.[7]

In order to analyze the migrations between high- and low-density provinces, we split provinces into low-density (LD) and high-density (HD) on the basis of the (time average) median value of the density, computed on individual observations. We then define the following groups in order to classify workers' movements: stayers in LD provinces, stayers in HD provinces, migrants from LD to HD provinces and migrants from HD to LD provinces. Workers in LD (HD) provinces who change job, but remain in an LD (HD) province, are classified as stayers in LD (HD) provinces, along with workers that remain in the same job in an LD (HD)

[5] We do not consider, as is standard practice in this literature, women and older workers since their wage dynamics is in fact often affected by non-economic factors, implying that economic and spatial covariates are less relevant in explaining their labor market outcomes (Topel, 1991).
[6] Note that in our sample we consider only workers with observations continuously available, i.e. available for consecutive years, since if data are missing for some years it is not possible to establish the patterns of worker's career dynamics. Moreover, we do not consider migrants before and after ten years from migration, since we claim that ten years are a sufficient time span to investigate the wage dynamics before and after the migration.
[7] The Italian provinces follow the European NUTS3 classification. We make use of 95 provinces, which was the number of provinces in the first year of analysis (1986). In recent years the number of provinces has risen to 103. Therefore, we reclassified the individuals belonging to the new provinces into the corresponding initial 95-province classification.

province. Further, if an individual moves more than once between HD and LD provinces, he/she may "score" more than once in the analysis.[8]

Table 1 shows the descriptive statistics for the different workers' groups. As expected, the average wage of stayers in LD provinces is lower than that of stayers in HD provinces, while the average wage for migrants lies in between those of stayers in LD and HD provinces, consistently with Mion and Naticchioni (2009). Migrants are also generally slightly younger than stayers and are relatively more concentrated in white collar occupations, as stayers in HD provinces. Further, migrants from LD to HD provinces as well as stayers in HD provinces work in larger firms. Finally, stayers in HD provinces and migrants from LD to HD density provinces are relatively more concentrated in the service sector, while the other groups of workers find greater representation in the industry sector.

[Table 1 around here]

## 4. Empirical Analysis

### 4.1 The Extent of the Wage Level and the Wage Growth Effect along the Wage Distribution.

We use a quantile regression approach to investigate the role of the wage level and the wage growth effect in determining the urban wage premium along the wage distribution. Following Glaeser and Marè (2001), we estimate a wage regression with dummies that capture the exact path of migration:

$$\ln(w_{i,t}) = \alpha_\theta + B_\theta^{'} * I\_Char_{i,t} + \beta_\theta * Firmsize_{i,t} + \sum_{j=1}^{T_i} \gamma_{j,\theta}^{l-h} I_{j,t}^{l-h} + \sum_{j=1}^{T_i} \gamma_{j,\theta}^{h-l} I_{j,t}^{h-l} + \phi_{s,\theta} + \lambda_{a,\theta} + \delta_{t,\theta} + \varepsilon_{i,t,\theta}$$

where $\theta$ refers to the percentile, $i$ to individuals, $s$ to sectors, $p$ to provinces, $t$ to time and $j$ stands for the dummies concerning year intervals before ("10 to 5", "4 to

[8] We did not consider workers moving three or more times between LD and HD provinces, who in any case account for a very small fraction of the workers in the sample.

3", "2 to 1"), after ("1 to 2", "3 to 4", "5 to 10") and for the migration year ("0")), with $j \in T_i$ is the individual time span.

The dependent variable in our regressions is the (log) real gross weekly wage in euro.[9] As for the variables of interest, $I_{j,t}^{l-h}$ (with j=(-10-5,…,+5-+10)) stands for a dummy variable that takes on a value of one when the worker, at time *t*, moved (will move) *j* years before (after) from a low- to a high-density province, while $I_{j,t}^{h-l}$ stands for a dummy variable that takes on a value of one if the worker, at time *t*, moved (will move) *j* years before (after) from a high-density to a low-density province. Hence, the estimates of $\gamma_j^{l-h}$ and $\gamma_j^{h-t}$ reflect the dynamics of wages before or after a move.

As for the other variables, the term $I\_Char_{i,t}$ is a set of observed individual characteristics (age, age squared, blue collar dummy) and $Firmsize_{i,t}$ is the proxy for firm heterogeneity,[10] while $\varphi_s$, $\lambda_a$, $\delta_t$ are sector, area (five macro-areas in Italy: Northwest, Northeast, Centre, South and Islands) and time dummies respectively. We carry out estimates for the 10th, 25th, 50th, 75th and 90th percentiles.

Table 2 shows the cross sectional quantile regression results. The omitted category is 'stayers in LD provinces'. We also provide the coefficients for the stayers in HD provinces. It is worth noting that stayers in HD provinces earn significantly more than stayers in LD provinces. This confirms that the bulk of wage differences across the space dimension is mainly due to stayers, as emphasized by Mion and Naticchioni (2009). Moreover, the urban wage premium for stayers in HD provinces with respect to those in LD provinces increases along the wage distribution, ranging from 2.3% at the bottom of the wage distribution to

[9] Wages have been deflated using the national Consumer Price Index (FOI index, *Indice dei Prezzi al Consumo per le Famiglie di Operai e Impiegati*, ISTAT). The base year is 2002. We do not apply cost of living adjustments for two main reasons. First, because we are interested in the firms' willingness to pay higher wages, and not in the location choice of workers. Second, because Baum-Snow and Pavan (2011) show that using wages not deflated by cost of living does not prove a major problem when working with differenced data. In our analysis this consideration applies since we work with deviations from within individual average.

[10] We proxy the firm heterogeneity using the firm size, since firm productivity and wages are positively related with firm size (Postel-Vinay and Robin, 2006, Krueger and Summers, 1988).

5.8% at the top. This means that skilled workers have a greater advantage in working in HD areas, consistently with Matano and Naticchioni (2011).[11]

Let us now move on to analysis of the groups of migrants, starting from the migrants from LD to HD provinces. To begin with, we must point out that using quantile regressions allows for better characterization of the wage dynamics of migrants, both before and after migration. More specifically, from Table 2 it emerges that skilled workers, at the 90$^{th}$ percentile, experience a wage increase even before migration, suggesting that the sample of migrants at the 90$^{th}$ percentile is positively selected, consistently with the intuitions of Borjas (1987). On the contrary, migrants at the 10$^{th}$ percentile represent a negative selection of the reference group of workers, since they experience a wage loss before migration. For workers at the median, instead, the wage dynamics before migration is not statistically different from that of the workers remaining in LD provinces. These findings suggests that unskilled workers mainly decide to migrate to a dense region after a negative shock in their current job, while for skilled workers the migration to dense regions is a tool to improve their already increasing wage dynamics. This characterization represents a further value added provided by the use of quantile regression.

As for the extent of the wage level and wage growth effect along the wage distribution, we begin with some considerations on the analysis of average wages, derived by using Ordinary Least Square. It may be noted that the wage level effect is quite small (1.2% with respect to a not statistically significant 0.7% just before migration) while the greatest part of the wage increase occurs after migration: the wage growth effect amounts to 13% (14.2% minus 1.2%). These findings are consistent with those of Glaeser and Maré (2001), who emphasize the importance of the wage growth effect.

Similar patterns are derived when considering the median, and this is hardly surprising since the distribution of the dependent variable, i.e. the log weekly wage, should come fairly close to a symmetric distribution. In particular, it emerges that at the median the entire wage premium arises essentially some years after

[11] In our analysis we can control for firm size, which represents -according to Lehmer and Moller (2010)- one of the main determinants of the urban wage premium.

migration (Table 2), since the wage level effect stands at zero (coefficients not statistically different from zero just before and after the migration).

Different and more interesting findings are derived when the tails of the wage distribution are taken into account. On the one hand, for workers at the bottom of the wage distribution (10th percentile) there is a slight negative wage level effect (-1.1%, from -6.1% to -7.2%). Nonetheless, in the years following migration wages tend to rise and after 3-4 years these workers earn significantly more than unskilled workers in LD provinces (+1.7%); the premium increases further after 5-10 years (+5.4%). This is in line with the wage growth hypothesis.

In the case of skilled workers (90th wage percentile) the pattern is different. In fact, the wage level effect is positive and amounts to a non-negligible 2.2% (from 4.1% to 6.3%). This finding suggests that for skilled workers agglomeration economies play a role in determining the urban wage premium. At the same time, there is evidence of a significant wage growth effect since the urban wage premium tends to increase over time (20% after 5-10 years).[12]

As for the migration from HD to LD provinces, it is noteworthy that, regardless of the wage percentile considered, there is no evidence of wage losses just after migration relative to 1-2 years before, consistently with the wage growth hypothesis and in line with Glaeser and Marè (2001). Rather, in some cases there is even a slight increase (1-2%).

[Table 2 around here]

However, these estimates might be biased since they do not take into account the role of the sorting of workers. Actually, part of the wage premium imputed to agglomeration economies, as well as human capital accumulation and quality matching, could be due to the sorting of skilled workers into cities. In order to tackle this issue, we perform fixed effects estimates that allow controlling for

[12] Adding up the wage level effect (difference between coefficients just after the migration and 1-2 years before) and the wage growth effect (difference between coefficients just after the migration and 5-10 years after), it comes out that the total increase in wages is of 11.5% for workers at the 10th percentile and of 16% for workers at the 90th percentile.

individual unobserved heterogeneity (Combes et al., 2008, Mion and Naticchioni, 2009, Matano and Naticchioni, 2011).

Since we work in a quantile setting, we make use of the quantile fixed effects methodologies proposed by Canay (2011) and Koenker (2004), which yield very similar findings (Table 3 and 4).[13] We comment on the estimates obtained applying the Canay (2011) methodology (Table 3). The omitted category within each group of migrants is that of '5 -10 years before the migration'.

The results in Table 3 confirm that sorting matters. In particular, considering the migrants from LD to HD provinces, the difference in coefficients between 1-2 years before migration and 5-10 years after generally decreases relative to previous estimates, and the reduction is greater at the highest percentiles, consistently with Matano and Naticchioni (2011).

In terms of decomposition between the wage growth and wage level effect, for the median and the mean the results differ little from previous ones, i.e. the wage level effect remains quite negligible and most of the wage increase occurs over time: the wage growth effect is equal to 4.8% at the median (5.5% minus 0.7% just after migration) and 5% at the mean (5.8% minus 0.8%).

Similarly, for low skilled workers the wage premium is essentially due to a wage growth effect: there is an increase immediately after migration (+2.1%, from -6.3% to -4.2%), but most of the urban wage premium emerges over time (+7.9%, from -4.2% to 3.7%).

Different and indeed interesting patterns emerge for skilled workers (at the 90$^{th}$ percentile), since most of the urban wage premium is due to a wage level effect (3.9%, from 3.2% to 7.1%), while the wage growth effect accounts only to an additional 0.9% wage increase (from 7.1% to 8%).

It is worth noting that for the group of migrants from LD to HD provinces the wage premia after 5-10 years from migration monotonically increase along the wage distribution, from 3.7% at the 10$^{th}$ percentile to 5.5% at the median and to 8% at the 90$^{th}$ percentile, even if the decomposition between the wage level and wage

[13] For a detailed description of these procedures see Matano and Naticchioni (2011), and the related papers of Canay (2011) and Koenker (2004) for further details.

growth effect differs depending on the percentile considered, as already pointed out.[14]

As for the migrants from HD to LD provinces, fixed effects estimates generally confirm the cross sectional results. In particular there is no evidence of wage losses just after migration -relative to 1-2 years before migration- from the median up to the 90th percentile (consistently with the wage growth hypothesis), while there is a 2.1% reduction for the 10th percentile.[15]

These findings suggest that while for unskilled workers the determinants of the urban wage premium appear to be due mainly to a wage growth effect, and hence to the coordination and/or learning explanation, for skilled workers the urban wage premium is more the result of a wage level effect related to the agglomeration explanation, even if wage growth still plays a role.

[Table 3 around here]

[Table 4 around here]

### 4.2 Focus on the Wage Growth Effect: Disentangling the "Learning" and the "Coordination" Effects along the Wage Distribution

One of the findings of our paper is that a non-negligible part of the urban wage premium is related to a wage growth effect, consistently with Glaeser and Maré (2001). As stressed in the literature, the wage growth effect could be the outcome of

[14] With fixed effect regressions, when we add up the wage level and the wage growth effect, a wage increase of 5% emerges at the 90th percentile (11 percentage points lower than in cross sectional estimates) and of around 10% at the 10th percentile (1.5 percentile points lower than in cross sectional estimates). This confirms that the sorting of workers affects the extent of the urban wage premium, particularly for high skilled workers (Matano and Naticchioni, 2011).

[15] As already stressed in the literature (Glaeser and Maré, 2001, Baum Snow and Pavan, 2011), fixed effects estimates have to be taken with some caution since the migrants might be a non-random sample of the population. This issue has been addressed by using for instance the sample of displaced workers (Dustmann and Meghir, 2005; Mion and Naticchioni, 2009). However, it has been shown that the sample of displaced workers can either over- or under-represent some characteristics of the original sample and therefore misrepresent the labour force (Matano and Naticchioni, 2011). Nonetheless, in the final part of the paper we show that the dynamics for migrants and stayers (in LD and HD provinces) do not significantly differ from one another, suggesting that our findings can be extended to the whole economy.

either faster human capital accumulation (learning) or more efficient job searching and matching (coordination). Our aim in this section is to disentangle the roles of the "learning" and "coordination" effects.

To begin with, we focus on the sample of migrants from LD to HD provinces, once they have moved into HD provinces. We include variables that are considered in the literature as proxy for the within-job wage growth (tenure, using a quadratic specification) and for the between-jobs wage growth (dummy for job change, as in Baum Snow and Pavan, 2011). We estimate the following regression:

$$\ln(w_{i,t}) = \alpha_\theta + B'_\theta * I\_Char_{i,t} + \beta_\theta * Firmsize_{i,t} + \gamma_1 * Tenure + \gamma_2 * TenureSq + \theta * JobChange + \\ + \varphi_{s,\theta} + \lambda_{a,\theta} + \delta_{t,\theta} + \varepsilon_{i,t,\theta}$$

where as before $\theta$ refers to the percentile, $i$ to individuals, $s$ to sectors, $p$ to provinces, $t$ to time.

The dependent variable is again the (log) real gross weekly wage in euro. The variables of interest are *Tenure, Tenure squared,* and the dummy *Job Change* that takes the value of 1 when a worker changes job in the corresponding year. All the other variables are the same as in the previous section. In Table 5 we set out the estimates derived by means of the quantile fixed effect regression methodology developed by Canay (2011), to control for the sorting of workers.

The results show that the impact of within- and between-jobs components on wages is not uniform along the wage distribution. In fact, the unskilled workers' wage growth (10th-25th wage percentile) is due mainly to positive –and concave- returns to tenure, suggesting that human capital accumulation plays a substantial role. Further, the linear coefficient of the returns to tenure decreases along the wage distribution, becoming negative at the 75th and 90th percentile, even if the quadratic term switches to positive. This suggests that for skilled workers job tenure does not contribute positively to wage growth.

As for the impact of job changes, this is positive for skilled workers (90th percentile), suggesting better matching opportunities in dense area, consistently with Wheeler (2006), while proving negative for unskilled workers.

Combining these findings, it clearly emerges that in dense areas unskilled workers advance in their careers by remaining in their jobs, while skilled workers benefit by changing jobs.

[Table 5 around here]

However, one might argue that the sample of migrants from low-to-high-density provinces is not representative of the whole economy (Mion and Naticchioni, 2009, Baum Snow and Pavan, 2011). For this reason, we carry out the same econometric specification -including tenure and job-to-job changes- on the sample of stayers in LD and HD provinces (Table 6), i.e. stayers in the sense that they remain in the same LD or HD area although they may change jobs within the area.[16] Since the results derived from the sample of stayers are, as we will see, similar to those derived from the group of migrants, our findings may well be taken as representative of the whole economy.

In the group of stayers the returns to tenure in both HD and LD provinces decrease along the wage distribution. More specifically, they are positive and concave for the bottom part of the wage distribution, and negative and convex for the highest part (in HD provinces they become insignificant). Further, the returns to tenure for workers in LD provinces are lower than for those in HD provinces, and are closer to those related to the group of migrants (table 5). We can therefore extend to the sample of stayers the finding derived in the sample of migrants, evidencing the fact that the accumulation of human capital over time is the main source of the urban wage premium for low skilled workers. More importantly, this effect is stronger for stayers in HD provinces than for those in LD provinces, suggesting a spatial effect.

As for the returns to job changes in the group of stayers, they are increasing along the wage distribution, as in the group of migrants. Nonetheless, even if the trends are similar, again the magnitude differs: in LD provinces, returns to job

[16] Note that for this analysis on the group of stayers we cannot consider the employment spells of individuals recorded in the database as working as from January 1986, since the formal beginning of all these jobs in the INPS database is forced to be January 1986, entailing that the tenure variable is left truncated.

change are negative at the 10th percentile (-4.1%), and switch to positive at the 90th percentile (1.6%); in HD provinces they are negative up to the 25th percentile and positive and increasing from the median (0.5%) up to the 90th percentile (3.9%). This evidence confirms the hypothesis that for skilled workers the driving force of the wage growth effect is the 'coordination' explanation, i.e. better matching opportunities, and this effect is much stronger in dense areas, revealing that the coordination hypothesis is correlated to the density of the local labor market.[17]

[Table 6 around here]

Moreover, we also verify whether there is a higher incidence of job changes in HD provinces, as argued in Yankow (2006), which would entail a greater cumulative wage growth. On the evidence of Table 7 the overall job change incidence can be seen to be basically the same for the group of stayers in LD provinces (11.1%) and for the group of stayers in HD provinces (10.8%), and a similar incidence is observed for the group of migrants from LD to HD provinces after migration (10.7%). However, since we work in a quantile framework we aim at enriching the analysis of Yankow (2006) by investigating whether the differences between LD and HD provinces in the incidence of job changes vary along the wage

[17] Our findings are to some extent not consistent with those derived by Baum Snow and Pavan (2011). However, there are many differences between the two papers. We consider prime age workers while they consider young individuals; we investigate the whole wage distribution while they consider the conditional mean; we use tenure as proxy for human capital accumulation while they use experience (we cannot recover the experience variable in our data), we work on Italian data while they investigate the US labour market. To make the two approaches more similar from a methodological point of view, we decided to carry out a robustness check using the age variable, which can approximate experience in the labour market. In particular, we use a specification including the linear term of age separated for workers in LD and HD provinces, and the quadratic term in common between LD and HD provinces, exactly as in Baum Snow and Pavan (2011) for the experience variable. In the specification we also include the job change dummies and all the covariates of Table 6. When focusing on the conditional mean, the results come closer to Baum Snow and Pavan (2011): the age coefficients are slightly higher in HD provinces, suggesting that human capital accumulation increases in dense areas. As for the returns to job change, the coefficients are negative and very close to zero, even if slightly less negative in HD provinces. This suggests that at the mean the coordination factor plays a very negligible role, as in Baum and Snow (2011). However, when considering the two tails of the distribution our findings are still confirmed: skilled workers benefit more from job changes (even if the differences with respect to LD provinces workers are now reduced) while unskilled workers benefit more from human capital accumulation. These estimates are available upon request.

distribution. To do so we compute the incidence of job changes for the four quartiles of the wage distribution. From Table 7 it emerges that for the first three quartiles of the wage distribution there are decidedly negligible differences in the incidence of job changes between the groups of stayers in LD provinces, the stayers in HD provinces and the LD-HD provinces migrants. Interestingly, for the fourth quartile the incidence of job changes for the group of stayers in HD provinces (10.3%) is significantly higher than for the group of stayers in LD provinces (8%), while an intermediate value is observed for the group of migrants from LD to HD provinces (9.3%). This evidence suggests that skilled workers show a higher incidence of job change in HD provinces. This also means that for skilled workers not only are the returns to each single job change higher in HD provinces (Table 6) but also the incidence of job change, suggesting that the cumulative returns to job changes are even higher than those shown in Table 6.

[Table 7 around here]

All these findings suggest that for skilled workers the driving force of wage dynamics in dense areas is largely a matter of better matching opportunities, while for unskilled workers it is within-job growth that plays a major role, in line with the learning explanation.

## 5. Conclusions

In this paper we investigate whether, and if so to what extent, the determinants of the urban wage premium, in terms of agglomeration economies, human capital accumulation and quality matching, differ along the wage distribution. Having controlled for the sorting of workers by means of quantile fixed effect regressions, we arrive at the following findings.

First, the patterns of the urban wage premium are far from homogeneous along the wage distribution. In particular, skilled workers enjoy higher wage premiums in terms of wage level effect, since most of the urban wage premium arises at the time of migration. Thus skilled workers benefit more from agglomeration

externalities. For low skilled workers the picture is reversed, since most of the urban wage premium arises some years after migration.

Second, we further investigate the determinants of the wage growth effect in dense areas. For both migrants to HD provinces and stayers in LD and HD provinces, within-job wage growth is an important driver of the wage growth effect for unskilled workers, and this effect is stronger in HD provinces: unskilled workers benefit more from human capital accumulation in dense areas. On the contrary, for skilled workers it is more the between-jobs wage growth that matters and this effect is stronger in HD provinces for both stayers and migrants from LD to HD provinces: in dense areas there are better matching opportunities for skilled workers.

**References**


Bacolod, M., Blum, B.S., Strange, W.C., (2009), "Skills in the City", Journal of Urban Economics, vol. 65(2): 136-153.

Baum-Snow, N., Pavan R., (2011), "Understanding the City Size Wage Gap", The Review of Economic Studies, doi: 10.1093/restud/rdr022.

Borjas, G.J., (1987), "Self-selection and earnings of immigrants", *American Economic Review*, 77: 531–53

Bleakley, H., Lin. J., (2007), "Thick-Market Effects and Churning in the Labor Market: Evidence from U.S. Cities", *Reserve Bank of Philadelphia Working Paper* 07-23.

Canay, I. (2011), "A Simple Approach to Quantile Regression for Panel Data", *The Econometrics Journal*, 14 (3): 368-386.

Ciccone, A., Hall, R. (1996), "Productivity and the Density of Economic Activity", *American Economic Review*, 86: 54-70.

Combes, P. (2000), Economic structure and local growth: France, 1984-1993, *Journal of Urban Economics*, 47: 329-355.

Combes, P., Duranton, G., Gobillon, L. (2008), "Spatial Wage Disparities: Sorting Matters!", *Journal of Urban Economics*, 63: 723-742.

Dustmann, C., Meghir, C. (2005), Wages, Experience and Seniority, *Review of Economic Studies*, 72: 77-108.

Glaeser, E.L. (1998), "Are cities dying?", *Journal of Economic Perspectives* 12:139–160.

Glaeser, E.L. (1999), "Learning in cities", *Journal of Urban Economics* 46: 254–277.

Glaeser, E.L., Maré, D.C. (2001), "Cities and Skills", *Journal of Labor Economics*, 19(2): 316-342.

Glaeser, E.L., Resseger, M.G. (2010), "The Complementarity Between Cities and Skills", *Journal of Regional Science*, 50(1): 221-244.

Gould, E.D. (2007), "Cities, Workers, and Wages: A Structural Analysis of the Urban Wage Premium" *Review of Economic Studies,* 74: 477-506.

Helsey R.W., Strange W.C. (1990), "Matching and agglomeration economies in a system of cities", *Regional Science and Urban Economics,* 28: 189–212.

Heuermann D., Halfdanarson B., Suedekum J., (2010), Human Capital Externalities and the Urban Wage Premium: two Literatures and their Interrelations", *Urban Studies*, 47(4): 749-767.

Kim, S. (1987) "Diversity in urban labor markets and agglomeration economies", *Papers of the Regional Science Association*, 62: 57–70.

Kim, S. (1990), "Labor heterogeneity, wage bargaining, and agglomeration economies", *Journal of Urban Economics,* 28: 160–177.

Koenker, R. (2004), "Quantile Regression for Longitudinal Data", *Journal of Multivariate Analysis*, 91(1): 74-89.

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

Lehmer F., Moller, J., (2010), "Interrelations between the urban wage premium and firm-size wage differentials: a microdata cohort analysis for Germany", *The Annals of Regional Science*, 45(1): 31-53.

Matano, A. and Naticchioni, P. (2011), Wage Distribution and the Spatial Sorting of Workers, *Journal of Economic Geography*, doi: 10.1093/jeg/Ibr013.

Mion, G., Naticchioni, P. (2009), The Spatial Sorting and Matching of Skills and Firms, *Canadian Journal of Economics*, Canadian Economics Association, 42(1): 28-55.

Moller, J., Haas, A., (2003), "The Agglomeration Differential Reconsidered: an investigation with German Micro Data 1984-1997". In J. Broecker, D. Dhose, R. Soltwedel (eds) *Innovation Clusters and Interregional Competition*, Berlin: Springler.

Moretti, E. (2004), "Human Capital Externalities in Cities", in Henderson J.V. and Thisse J.F. (eds.), *Handbook of Regional and Urban Economics*, Elsevier-North Holland, Amsterdam, 4.

Postel-Vinay, F., Robin, J.M. (2006), "Microeconometric Search-Matching Models and Matched Employer-Employee Data", in R. Blundell, W. Newey and T. Persson (eds.), *Advances in Economics and Econometrics: Theory and Applications*, Ninth World Congress, 2, Cambridge: Cambridge University Press.

Topel, R. (1991), Specific capital, mobility, and wages: Wages rise with job seniority, *Journal of Political Economy*, 99: 145-176.

Wheeler, C.H., (2004), "Wage inequality and urban density", *Journal of Economic Geography*, 4: 412-437.

Wheeler, C.H., (2006), "Cities and the growth of wages among young workers: Evidence from the NLSY", *Journal of Urban Economics,* 60(2):162-184.

Yankow, J., (2006), "Why do cities pay more? An empirical examination of some competing theories of the urban wage premium", *Journal of Urban Economics* 60(2): 139-161.

## Tables

**Table 1: Descriptive Statistics for stayers and migrants**

| | Stayers Low Density (199,282) | | | | Stayers High Density (218,804) | | | |
|---|---|---|---|---|---|---|---|---|
| **Variables** | **Mean** | **Std.Dev.** | **Min** | **Max** | **Mean** | **Std.Dev.** | **Min** | **Max** |
| Real Weekly Wage | 6.00 | 0.38 | 4.25 | 8.73 | 6.16 | 0.44 | 4.25 | 9.23 |
| Age | 41.92 | 8.07 | 25 | 66 | 42.27 | 8.09 | 25 | 67 |
| Blue Collar | 0.70 | 0.46 | 0 | 1 | 0.57 | 0.50 | 0 | 1 |
| White Collar | 0.30 | 0.46 | 0 | 1 | 0.43 | 0.50 | 0 | 1 |
| Firm Size | 4.61 | 2.69 | 0 | 12.11 | 5.26 | 2.77 | 0 | 12.11 |
| North West | 0.22 | 0.41 | 0 | 1 | 0.52 | 0.50 | 0 | 1 |
| North East | 0.24 | 0.43 | 0 | 1 | 0.23 | 0.42 | 0 | 1 |
| Centre | 0.21 | 0.41 | 0 | 1 | 0.18 | 0.39 | 0 | 1 |
| South | 0.22 | 0.41 | 0 | 1 | 0.07 | 0.25 | 0 | 1 |
| Island | 0.11 | 0.31 | 0 | 1 | 0.00 | 0.00 | 0 | 0 |
| Industry | 0.65 | 0.48 | 0 | 1 | 0.58 | 0.49 | 0 | 1 |
| Services | 0.35 | 0.48 | 0 | 1 | 0.42 | 0.49 | 0 | 1 |
| | **Migrants Low-High Density (19,845)** | | | | **Migrants High-Low Density (19,869)** | | | |
| **Variables** | **Mean** | **Std.Dev.** | **Min** | **Max** | **Mean** | **Std.Dev.** | **Min** | **Max** |
| Real Weekly Wage | 6.14 | 0.50 | 4.41 | 8.87 | 6.13 | 0.50 | 4.34 | 8.74 |
| Age | 40.63 | 7.89 | 25 | 66 | 40.56 | 7.99 | 25 | 67 |
| Blue Collar | 0.54 | 0.50 | 0 | 1 | 0.54 | 0.50 | 0 | 1 |
| White Collar | 0.46 | 0.50 | 0 | 1 | 0.46 | 0.50 | 0 | 1 |
| Firm Size | 5.35 | 2.75 | 0 | 12.07 | 5.12 | 2.56 | 0 | 12.02 |
| North West | 0.34 | 0.47 | 0 | 1 | 0.37 | 0.48 | 0 | 1 |
| North East | 0.25 | 0.43 | 0 | 1 | 0.24 | 0.43 | 0 | 1 |
| Centre | 0.21 | 0.41 | 0 | 1 | 0.19 | 0.40 | 0 | 1 |
| South | 0.14 | 0.35 | 0 | 1 | 0.16 | 0.36 | 0 | 1 |
| Island | 0.05 | 0.22 | 0 | 1 | 0.04 | 0.19 | 0 | 1 |
| Industry | 0.60 | 0.49 | 0 | 1 | 0.63 | 0.48 | 0 | 1 |
| Services | 0.40 | 0.49 | 0 | 1 | 0.37 | 0.48 | 0 | 1 |

Source: Panel INPS (processed by ISFOL) data. Real Weekly Wage and Firm Size are in logarithm. Number of observations in brackets.

**Table 2: Wage Dynamics of Migrants. Quantile Regression.**

| | q10 | q25 | q50 | q75 | q90 | mean |
|---|---|---|---|---|---|---|
| **Stayers living in a HD Province** | 0.023*** | 0.023*** | 0.035*** | 0.049*** | 0.058*** | 0.047*** |
| | [0.001] | [0.001] | [0.001] | [0.001] | [0.002] | [0.001] |
| **Moving to a HD province:** | | | | | | |
| **Observed 5-10 years before a move** | 0.018** | 0.010** | 0.005 | 0.003 | 0.010 | 0.025*** |
| | [0.008] | [0.005] | [0.005] | [0.005] | [0.010] | [0.005] |
| **Observed 3-4 years before a move** | -0.006 | 0.003 | 0.015** | 0.024*** | 0.026** | 0.028*** |
| | [0.008] | [0.005] | [0.006] | [0.007] | [0.012] | [0.006] |
| **Observed 1-2 years before a move** | -0.061*** | -0.020*** | -0.004 | 0.021*** | 0.041*** | 0.007 |
| | [0.008] | [0.005] | [0.004] | [0.006] | [0.010] | [0.005] |
| **Observed within a year after a move** | -0.072*** | -0.026*** | -0.001 | 0.028*** | 0.063*** | 0.012* |
| | [0.015] | [0.008] | [0.009] | [0.010] | [0.013] | [0.006] |
| **Observed 1-2 years after a move** | -0.021*** | 0.000 | 0.031*** | 0.078*** | 0.094*** | 0.057*** |
| | [0.008] | [0.007] | [0.004] | [0.006] | [0.015] | [0.006] |
| **Observed 3-4 years after a move** | 0.017** | 0.028*** | 0.062*** | 0.113*** | 0.159*** | 0.096*** |
| | [0.008] | [0.009] | [0.008] | [0.012] | [0.021] | [0.007] |
| **Observed 5-10 years after a move** | 0.054*** | 0.054*** | 0.099*** | 0.158*** | 0.201*** | 0.142*** |
| | [0.006] | [0.007] | [0.008] | [0.012] | [0.013] | [0.007] |
| **Moving to a LD province:** | | | | | | |
| **Observed 5-10 years before a move** | 0.030** | 0.035*** | 0.045*** | 0.049*** | 0.062*** | 0.054*** |
| | [0.013] | [0.005] | [0.005] | [0.008] | [0.013] | [0.006] |
| **Observed 3-4 years before a move** | 0.000 | 0.016*** | 0.040*** | 0.053*** | 0.057*** | 0.050*** |
| | [0.008] | [0.006] | [0.005] | [0.010] | [0.008] | [0.007] |
| **Observed 1-2 years before a move** | -0.085*** | -0.032*** | 0.008 | 0.039*** | 0.071*** | 0.006 |
| | [0.011] | [0.006] | [0.005] | [0.006] | [0.010] | [0.005] |
| **Observed within a year after a move** | -0.082*** | -0.020*** | 0.014*** | 0.058*** | 0.074*** | 0.026*** |
| | [0.017] | [0.008] | [0.003] | [0.008] | [0.012] | [0.006] |
| **Observed 1-2 years after a move** | -0.048*** | -0.002 | 0.018*** | 0.066*** | 0.089*** | 0.043*** |
| | [0.011] | [0.005] | [0.005] | [0.006] | [0.011] | [0.005] |
| **Observed 3-4 years after a move** | 0.007 | 0.026*** | 0.044*** | 0.080*** | 0.098*** | 0.069*** |
| | [0.011] | [0.007] | [0.006] | [0.008] | [0.020] | [0.007] |
| **Observed 5-10 years after a move** | 0.039*** | 0.038*** | 0.043*** | 0.071*** | 0.111*** | 0.077*** |
| | [0.008] | [0.006] | [0.005] | [0.006] | [0.021] | [0.006] |
| **N. of Observations** | 457,800 | 457,800 | 457,800 | 457,800 | 457,800 | 457,800 |
| **N. of Individuals** | 46,822 | 46,822 | 46,822 | 46,822 | 46,822 | 46,822 |

Notes: Standard Errors in Parenthesis with ***,** and * denoting significance at 1%, 5% and 10% respectevely. Control variables are age, age squared, occupation dummies, firm size and area, sector and time dummies. Omitted category: non movers in low density provinces.

| Table 3: Wage Dynamics of Migrants. Quantile Fixed Effects Regression (Canay, 2011). | | | | | | |
|---|---|---|---|---|---|---|
| | **q10** | **q25** | **q50** | **q75** | **q90** | **mean** |
| **Stayers living in a HD Province** | - | - | - | - | - | |
| **Moving to a HD province:** | | | | | | |
| **Observed 5-10 years before a move** | - | - | - | - | - | |
| **Observed 3-4 years before a move** | -0.030*** | -0.003 | 0.003 | 0.005** | 0.020*** | -0.005 |
| | [0.007] | [0.003] | [0.002] | [0.002] | [0.005] | [0.004] |
| **Observed 1-2 years before a move** | -0.063*** | -0.024*** | -0.011*** | 0.005* | 0.032*** | -0.019*** |
| | [0.007] | [0.003] | [0.001] | [0.003] | [0.004] | [0.004] |
| **Observed within a year after a move** | -0.042*** | -0.009*** | 0.007*** | 0.034*** | 0.071*** | 0.008* |
| | [0.007] | [0.003] | [0.003] | [0.003] | [0.008] | [0.005] |
| **Observed 1-2 years after a move** | 0.012*** | 0.018*** | 0.031*** | 0.050*** | 0.072*** | 0.035*** |
| | [0.004] | [0.002] | [0.002] | [0.003] | [0.006] | [0.005] |
| **Observed 3-4 years after a move** | 0.031*** | 0.033*** | 0.043*** | 0.056*** | 0.075*** | 0.046*** |
| | [0.005] | [0.002] | [0.003] | [0.005] | [0.009] | [0.005] |
| **Observed 5-10 years after a move** | 0.037*** | 0.039*** | 0.055*** | 0.069*** | 0.080*** | 0.058*** |
| | [0.006] | [0.003] | [0.002] | [0.003] | [0.005] | [0.005] |
| **Moving to a LD province:** | | | | | | |
| **Observed 5-10 years before a move** | - | - | - | - | - | |
| **Observed 3-4 years before a move** | -0.019*** | 0.001 | 0.016*** | 0.029*** | 0.051*** | 0.014*** |
| | [0.005] | [0.005] | [0.003] | [0.003] | [0.006] | [0.005] |
| **Observed 1-2 years before a move** | -0.029*** | 0.006* | 0.030*** | 0.052*** | 0.091*** | 0.025*** |
| | [0.007] | [0.003] | [0.002] | [0.002] | [0.007] | [0.004] |
| **Observed within a year after a move** | -0.050*** | 0.005 | 0.036*** | 0.057*** | 0.101*** | 0.030*** |
| | [0.010] | [0.006] | [0.004] | [0.005] | [0.010] | [0.005] |
| **Observed 1-2 years after a move** | 0.003 | 0.033*** | 0.048*** | 0.065*** | 0.082*** | 0.044*** |
| | [0.003] | [0.003] | [0.002] | [0.003] | [0.006] | [0.005] |
| **Observed 3-4 years after a move** | 0.031*** | 0.049*** | 0.054*** | 0.065*** | 0.082*** | 0.056*** |
| | [0.007] | [0.004] | [0.003] | [0.006] | [0.008] | [0.005] |
| **Observed 5-10 years after a move** | 0.030*** | 0.039*** | 0.048*** | 0.061*** | 0.082*** | 0.050*** |
| | [0.004] | [0.002] | [0.002] | [0.003] | [0.006] | [0.005] |
| **N. of Observations** | 457,800 | 457,800 | 457,800 | 457,800 | 457,800 | 457,800 |
| **N. of Individuals** | 46,822 | 46,822 | 46,822 | 46,822 | 46,822 | 46,822 |

Notes: Standard Errors in Parenthesis with ***,** and * denoting significance at 1%, 5% and 10% respectevely. Control variables are age, age squared, occupation dummies, firm size and area, sector and time dummies.

**Table 4: Wage Dynamics of Migrants. Quantile Fixed Effects Regression (Koenker, 2004).**

| | q10 | q25 | q50 | q75 | q90 | mean |
|---|---|---|---|---|---|---|
| **Stayers living in a HD Province** | - | - | - | - | - | |
| **Moving to a HD province:** | | | | | | |
| **Observed 5-10 years before a move** | - | - | - | - | - | |
| **Observed 3-4 years before a move** | -0.023 | -0.001 | 0.002 | 0.001 | 0.003 | -0.005 |
| | [0.018] | [0.005] | [0.004] | [0.005] | [0.006] | [0.004] |
| **Observed 1-2 years before a move** | -0.066*** | -0.022*** | -0.01 | 0.005 | 0.031*** | -0.019*** |
| | [0.019] | [0.008] | [0.006] | [0.006] | [0.012] | [0.004] |
| **Observed within a year after a move** | -0.049*** | -0.009 | 0.008 | 0.032*** | 0.065*** | 0.008* |
| | [0.013] | [0.010] | [0.007] | [0.008] | [0.012] | [0.005] |
| **Observed 1-2 years after a move** | 0.011 | 0.017 | 0.027*** | 0.040*** | 0.057*** | 0.035*** |
| | [0.011] | [0.011] | [0.007] | [0.010] | [0.015] | [0.005] |
| **Observed 3-4 years after a move** | 0.026** | 0.032*** | 0.038*** | 0.048*** | 0.062*** | 0.046*** |
| | [0.011] | [0.008] | [0.008] | [0.010] | [0.013] | [0.005] |
| **Observed 5-10 years after a move** | 0.042*** | 0.041*** | 0.053*** | 0.065*** | 0.080*** | 0.058*** |
| | [0.010] | [0.010] | [0.009] | [0.010] | [0.017] | [0.005] |
| **Moving to a LD province:** | | | | | | |
| **Observed 5-10 years before a move** | - | - | - | - | - | |
| **Observed 3-4 years before a move** | -0.021 | -0.004 | 0.012** | 0.023*** | 0.039*** | 0.014*** |
| | [0.017] | [0.011] | [0.005] | [0.007] | [0.015] | [0.005] |
| **Observed 1-2 years before a move** | -0.041*** | 0.002 | 0.028*** | 0.050*** | 0.083*** | 0.025*** |
| | [0.015] | [0.012] | [0.006] | [0.009] | [0.011] | [0.004] |
| **Observed within a year after a move** | -0.056** | 0.006 | 0.036*** | 0.056*** | 0.088*** | 0.030*** |
| | [0.023] | [0.013] | [0.007] | [0.008] | [0.012] | [0.005] |
| **Observed 1-2 years after a move** | 0.005 | 0.037*** | 0.049*** | 0.060*** | 0.075*** | 0.044*** |
| | [0.027] | [0.010] | [0.007] | [0.012] | [0.013] | [0.005] |
| **Observed 3-4 years after a move** | 0.041*** | 0.051*** | 0.055*** | 0.059*** | 0.077*** | 0.056*** |
| | [0.010] | [0.008] | [0.008] | [0.009] | [0.014] | [0.005] |
| **Observed 5-10 years after a move** | 0.039** | 0.048*** | 0.053*** | 0.062*** | 0.073*** | 0.050*** |
| | [0.016] | [0.010] | [0.009] | [0.011] | [0.014] | [0.005] |
| **N. of Observations** | 457,800 | 457,800 | 457,800 | 457,800 | 457,800 | 457,800 |
| **N. of Individuals** | 46,822 | 46,822 | 46,822 | 46,822 | 46,822 | 46,822 |

Notes: Bootstrapped Standard Errors in Parenthesis with ***,** and * denoting significance at 1%, 5% and 10% respectevely. The bootstrapping was done using the entire sample and 500 iterations. Control variables are age, age squared, occupation dummies, firm size and area, sector and time dummies.

**Table 5: Returns to Tenure and to Job Changes. Sample of Migrants from Low to High Density Provinces after the Migration (Canay, 2011).**

| | q10 | q25 | q50 | q75 | q90 | Mean |
|---|---|---|---|---|---|---|
| Job-to-Job | -0.036*** | -0.022*** | -0.008** | 0.008 | 0.029** | -0.010 |
| | [0.013] | [0.004] | [0.004] | [0.007] | [0.012] | [0.007] |
| Tenure | 0.014*** | 0.004** | 0.000 | -0.004*** | -0.011*** | 0.000 |
| | [0.004] | [0.002] | [0.001] | [0.001] | [0.003] | [0.003] |
| Tenure squared | -0.002*** | -0.001*** | 0.000 | 0.001*** | 0.001*** | 0.000 |
| | [0.000] | [0.000] | [0.000] | [0.000] | [0.000] | [0.000] |
| Age | 0.077*** | 0.070*** | 0.066*** | 0.065*** | 0.060*** | 0.070*** |
| | [0.005] | [0.002] | [0.001] | [0.001] | [0.004] | [0.005] |
| Age squared | -0.001*** | -0.001*** | -0.001*** | -0.000*** | -0.000*** | -0.001*** |
| | [0.000] | [0.000] | [0.000] | [0.000] | [0.000] | [0.000] |
| Firm Size | 0.011*** | 0.011*** | 0.010*** | 0.010*** | 0.010*** | 0.010*** |
| | [0.001] | [0.001] | [0.001] | [0.001] | [0.001] | [0.002] |
| Blue Collar Dummy | -0.132*** | -0.125*** | -0.128*** | -0.130*** | -0.135*** | -0.132*** |
| | [0.006] | [0.003] | [0.002] | [0.004] | [0.005] | [0.021] |
| Constant | 3.929*** | 4.165*** | 4.331*** | 4.432*** | 4.575*** | 4.248*** |
| | [0.118] | [0.050] | [0.042] | [0.032] | [0.105] | [0.129] |
| N. of Observations | 8,675 | 8,675 | 8,675 | 8,675 | 8,675 | 8,675 |
| N. of Individuals | 1,743 | 1,743 | 1,743 | 1,743 | 1,743 | 1,743 |

Notes: Standard Errors in Parenthesis with ***,** and * denoting significance at 1%, 5% and 10% respectevely. The other control variables are area, sector and time dummies.

**Table 6: Returns from Tenure and Job Changes into High (HD) and Low Density (LD) Provinces. Sample of Stayers. Quantile Fixed Effects Estimates (Canay, 2011).**

| | q10 | q25 | q50 | q75 | q90 | mean |
|---|---|---|---|---|---|---|
| Job-to-Job HD | -0.013*** | -0.005*** | 0.005*** | 0.020*** | 0.039*** | 0.010*** |
| | [0.003] | [0.001] | [0.001] | [0.002] | [0.003] | [0.002] |
| Job-to-Job LD | -0.041*** | -0.025*** | -0.014*** | 0.000 | 0.016*** | -0.012*** |
| | [0.003] | [0.002] | [0.001] | [0.002] | [0.003] | [0.002] |
| Tenure HD | 0.021*** | 0.011*** | 0.005*** | 0.002*** | -0.001 | 0.009*** |
| | [0.001] | [0.000] | [0.000] | [0.000] | [0.001] | [0.001] |
| Tenure squared HD | -0.002*** | -0.001*** | -0.000*** | -0.000*** | 0.000 | -0.001*** |
| | [0.000] | [0.000] | [0.000] | [0.000] | [0.000] | [0.000] |
| Tenure LD | 0.015*** | 0.005*** | -0.001*** | -0.004*** | -0.009*** | 0.002*** |
| | [0.001] | [0.000] | [0.000] | [0.000] | [0.001] | [0.001] |
| Tenure squared LD | -0.001*** | -0.001*** | -0.000*** | 0.000*** | 0.000*** | -0.000*** |
| | [0.000] | [0.000] | [0.000] | [0.000] | [0.000] | [0.000] |
| Age | 0.066*** | 0.060*** | 0.057*** | 0.054*** | 0.050*** | 0.059*** |
| | [0.001] | [0.000] | [0.000] | [0.000] | [0.001] | [0.001] |
| Age squared | -0.001*** | -0.000*** | -0.000*** | -0.000*** | -0.000*** | -0.000*** |
| | [0.000] | [0.000] | [0.000] | [0.000] | [0.000] | [0.000] |
| Firm Size | 0.017*** | 0.015*** | 0.014*** | 0.013*** | 0.010*** | 0.014*** |
| | [0.000] | [0.000] | [0.000] | [0.000] | [0.000] | [0.000] |
| Blue Collar Dummy | -0.072*** | -0.077*** | -0.081*** | -0.089*** | -0.109*** | -0.088*** |
| | [0.001] | [0.001] | [0.000] | [0.001] | [0.002] | [0.003] |
| Constant | 4.087*** | 4.356*** | 4.511*** | 4.671*** | 4.886*** | 4.474*** |
| | [0.020] | [0.011] | [0.008] | [0.011] | [0.013] | [0.020] |
| N. of Observations | 221,549 | 221,549 | 221,549 | 221,549 | 221,549 | 221,549 |
| N. of Individuals | 27,771 | 27,772 | 27,773 | 27,774 | 27,775 | 27,776 |

Notes: Standard Errors in Parenthesis with ***,** and * denoting significance at 1%, 5% and 10% respectevely. The other control variables are area, sector and time dummies.

**Table 7: Incidence of job changes along the quartiles of the wage distribution. Samples of Stayers in LD, Stayers in HD, and migrants from LD to HD after the migration.**

| | Stayers in LD | Stayers in HD | Migrants LD-HD |
|---|---|---|---|
| Overall | 11.1 | 10.8 | 10.7 |
| 1th quartile | 14.2 | 14.1 | 15.7 |
| 2nd quartile | 10.9 | 10.4 | 11.0 |
| 3rd quartile | 9.2 | 9.2 | 8.6 |
| 4th quartile | 8.0 | 10.3 | 9.3 |

IREA

Institut de Recerca en Economia Aplicada Regional i Públic
*Research Institute of Applied Economics*

**WEBSITE:** www.ub-irea.com • **CONTACT:** irea@ub.edu

AQR

Grup de Recerca Anàlisi Quantitativa Regional
*Regional Quantitative Analysis Research Group*

**WEBSITE:** www.ub.edu/aqr/ • **CONTACT:** aqr@ub.edu

**Universitat de Barcelona**
Av. Diagonal, 690 • 08034 Barcelona