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

Alessia Matano[*] and Paolo Naticchioni[†]

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Abstract

The urban wage premium is a stylized fact within the spatial economic literature with different explanations that have been proposed, such as the relevance of agglomeration externalities, the accumulation of human capital and a better matching between workers and firms. This paper aims at disentangling between these possible explanations, analyzing migration flows from non-urban to urban areas over time. The innovative contribution of the paper is to use a quantile approach, in order to assess how, and to what extent, the determinants of the urban wage premium differ along the wage distribution. We focus on the Italian case, using individual panel data, to take also into account the role of sorting. Results point out that skilled workers enjoy a higher wage premium when they migrate, in line with agglomeration externalities explanations, while unskilled workers seem to benefit more of a wage premium accruing over time. Disentangling further the determinants of the wage growth, we found that for unskilled workers this is due to human capital accumulation over time, consistently with the "learning" hypothesis, while for skilled workers is more the "coordination" hypothesis that plays a role.

JEL Classification: J31, J61, R23.

Keywords: Spatial Externalities, Human Capital Accumulation, Spatial Sorting, Migration, Wage Distribution, Quantile Fixed Effects.

[*] Alessia Matano, University of Rome "La Sapienza", Dipartimento di Analisi Economiche e Sociali. Email: alexis.rtd@gmail.com.

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

Introduction

The existence and extent of the urban wage premium has been widely investigated in the spatial economic literature, both from a theoretical and empirical point of view. From a theoretical point of view, different theories have been advanced to explain the urban wage premium. Standard theories argue that wages and productivity are higher in cities due to agglomeration externalities in terms of reduced transport costs, technological and knowledge spillovers, cheaper inputs, proximity to consumers (Glaeser, 1998, Kim, 1987, Ciccone and Hall, 1996). According to these theories, workers moving to cities should immediately experience wage increases, while those leaving cities should experience wage losses (wage level effects). More recently, a "learning" hypothesis has been proposed, which predicts that cities enhance human capital accumulation, i.e. cities make workers more productive over time and, hence, workers moving to cities will only experience wage increases over time, while those leaving cities would not necessary experience wage losses (wage growth effect, Glaeser and Marè, 2001). Moreover, also the "coordination" hypothesis takes place within a dynamic context, since cities enhance the probability to have a better match between workers and firms, and this probability increases with the time spent in cities (Kim, 1990, Yankow 2006). It is also important to stress that the urban wage premium, at least partially, could be the outcome of the sorting of workers, i.e. high skilled workers sort into cities (Combes et al. 2008, Mion and Naticchioni, 2009, Matano and Naticchioni, 2011).

These explanations have been discussed and tested in Glaeser and Marè (2001), who analyze the determinants of the urban wage premium in the US using data from the NLSY and PSID datasets. In particular, they analyze the migration flows from non-urban to urban areas (and vice versa), in order to distinguish the role of the wage growth effect and the wage level effect in shaping the urban wage premium. Glaeser and Marè (2001) also perform fixed effects estimates to check how the urban wage premium changes when the sorting of workers is taken into account. Their results show that part of the urban wage premium accrues to workers over time and stay with them when leaving cities. This evidence supports the view that a significant fraction of the urban wage premium is a wage growth effect, thus pointing out that cities speed the accumulation of human capital. Nonetheless, they find also evidence supporting the wage level effect.

More recently, other papers have extended the analysis of Glaeser and Marè (2001) to further disentangle the determinants of the wage growth in cities, focusing on the

"within" and "between" jobs wage growth components that represent a proxy of the "learning" and "coordination" hypothesis (Yankow, 2006, Wheeler, 2006, Kim, 2004).[1]

The original contribution of this paper is to investigate the urban wage premium along the wage distribution, as well as the role played by the different explanations outlined. In this way we are able to assess whether the determinants of the urban wage premiums differ when considering workers located at different points of the wage distribution, a relatively unexplored field of research in the spatial economic literature. We make use of the Italian employer-employee INPS database, from 1986-2003 and we analyze the migration patterns from low-to-high and high-to-low density provinces, by means of a quantile regression approach. Moreover, since previous empirical studies have shown that the sorting of workers generally captures an important 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 unobserved workers' heterogeneity by carrying out quantile fixed effects estimations.

We derive the following findings. First, our analysis confirms that the sorting of workers is relevant since when taking into account the individual heterogeneity wage premiums are reduced, especially for high skilled workers. Second, high skilled workers enjoy a higher immediate wage premium when moving from a low to a high density province, while for low skilled workers the wage premium take place essentially over time. Hence, while for high skilled workers a large part of the urban wage premium comes out from a wage level effect, for low skilled workers the urban wage premium is substantially due to a wage growth effect.

We also disentangle the relevance of the "learning" and "coordination" hypothesis on the wage growth. Therefore, we focus on the sample of migrants from low-to-high density provinces after the migration, and analyze within a quantile framework the impact of job changes (proxy for between jobs wage growth) and tenure (proxy for within jobs wage growth) on wages. Our findings show that, once controlled for the sorting of workers, skilled workers benefit more from a better matching between workers and firms in areas of high dense economic activity, while low skilled workers seem to benefit more from higher human capital accumulation. These findings underline that taking into account the distributional dimension is relevant, since the determinants of the urban wage premium differ along the wage distribution.

[1] For an update survey of papers on this topic see Halfdanarson et al. (2008).

The structure of the paper is as follows. In Section 2 we review the theoretical and empirical literature concerning the urban wage premium. In Section 3, we describe the data and define the spatial variables. Section 4 presents the empirical analysis and discusses the main results. Section 5 draws the conclusions.

2. Related Literature

The urban wage premium is one of the topics at the core of the spatial econometric literature since ever, both at the theoretical and empirical level. From a theoretical point of view, the different explanations can be summarized in the following categories: agglomeration economies, i.e. the 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 technological spillovers between firms, proximity to consumers, Ciccone and Hall, 1996, Kim, 1987, Glaeser, 1998); the "learning" mechanism, i.e. cities enhance the accumulation of human capital due to the acceleration of face-to-face interactions, particularly with skilled people who are 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 since in cities there is a higher rate of job openings, which increases the opportunity of receiving a good offer, related also to a reduction in search time and travel costs for job vacancy (Kim, 1990, Helsey and Strange, 1990, Yankow, 2006); the sorting of high ability workers into cities, i.e. skilled workers are attracted by cities since cities offer a wide of amenities and makes skilled workers more productive (Combes et al., 2008, Mion and Naticchioni, 2009, Matano and Naticchioni, 2011, Bacolod, Blum and Strange, 2009).

All these explanations can potentially play a role in affecting 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" hypothesis imply that wages in cities increase only with time spent in the cities (wage growth effect).

At the empirical level some works have addressed these issues. The pioneer work is Glaeser and Marè (2001), who analyze for the US the migration flows from non-urban 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). If the wage growth hypothesis prevails, workers moving to cities will experience wage growth only over time, and will not

experience wage losses when leaving cities. If the wage level effect applies, migrants will rather experience immediate wage increases after moving to cities and wage losses when leaving cities. Further, they also perform fixed effects estimates to check how the urban wage premium changes when the sorting of workers is taken into account. Their results show that there is evidence supporting both the wage growth and wage level effect. They interpret the wage growth effect as evidence of human capital accumulation and the wage level effect as evidence of agglomeration economies.

Lehmer and Moller (2010) analyze the determinants of the urban wage premium in Germany in terms of wage level and wage growth effects. However, they focus not only on the mobility defined in terms of migration from rural to urban areas and vice versa, but also on the mobility in terms of the workers moving to firms of different size (from small to large), deriving the following findings. First, they confirm the existence of a sizeable urban wage premium, which is reduced when controlling for firms size, suggesting that interregional firm-size differences explain a significant part of the urban wage premium. Second, they point out that in general the urban wage premium is more due to a wage growth effect related to human capital accumulation, than to a wage level effect, especially for more experienced workers. They also do not find any particular relevance of the sorting of workers in explaining the urban wage premium.[2] Third, they show that the firm-size earning differential is due to both a wage level and a wage growth effect. Finally, introducing cross sectional effects between inter-regional and firm-size migrations, they find out a more important role for the wage level effect for rural-urban migrants employed in larger firms, even if the wage growth mechanism is also still at play. All in all, the analysis leads to the conclusion that large firms play a significant role in explaining the wage premium in urban areas, while at the same time evidencing that wage growth in urban areas is not only related to the firm dimension.

Another related paper is Yankow (2006), who builds on the work of Glaeser and Marè (2001). Yankow (2006) investigates the determinants of the wage growth focusing in particular on the "coordination" effect, i.e. the role played by "between" job wage growths, using data from the US. His results show the existence of a sizeable urban wage premium, even after controlling for the sorting of high ability workers into cities. This is due to a large extent to a wage level effect, while the wage growth effect plays a minor but important role, since in the four years after the migration there is a consistent increase in wages for non-urban to urban migrants. He then analyzes the wage growth related to the "between job" dynamics in order to shed some light on the relevance of the "coordination" hypothesis. He finds out that workers in large cities

[2] This is also because of the specific characteristics of the cohort sample selected, which eliminates a large part already of the problems related to heterogeneity.

receive higher cumulative between jobs wage growth. However, he also show that there is no any statistical difference between urban and non urban workers in the average wage gain from a single job change. This evidence suggests that it is not the premium to each job change that matters but it is the fact that that in cities there is a significantly higher frequency of job changes, entailing a higher cumulative wage growth related to job changes.

Another interesting work is Wheeler (2006) who focuses on the wage growth within and across cities in the US. His findings show that, on average, wage growth tends to be positively associated with the size of the local market size (in term of resident population, population density and industrial diversity). Further, Wheeler (2006) is also interested in disentangling the role of "within" job wage growth, which proxies the "learning" mechanism, from the "between" job wage growth, which proxies the "coordination" effect. He points out that faster wage growth seems to be related to job changes, rather than to the return to tenure. These results highlight that cities enhance worker productivity mainly through a process of better matching between workers and firms that take place with time spent in the city.

Bleakley and Lin (2007) show that a source of the urban wage premium is the difference in the matching opportunities between those workers residing in cities and those in rural areas. In fact, one the one hand, they found that young workers have a superior rate of change jobs in cities, which highlight that matching opportunities are higher for them in cities and can allow them to reach the perfect match with time. Therefore young workers have more incentive in investing in some firm or sector specific human capital since they can expect to stay longer within a firm. On the other hand, they found that job changes are higher for workers in rural areas, and this is due to the fact that they have to change job more often since best matches are less likely to occur given the limited number of employers and this entails a higher rate of depreciation of specific human capital for workers in rural areas (due to the higher rate of job changes).

The analysis of Kim (2004) uses the same data of Glaeser and Marè (2001), but extends the period of the analysis until 1991. His findings show that while cross-sectional estimates indicate a substantial urban/non urban wage gap, by means of mean-differenced estimates the wage gap is just sufficient to compensate the difference in cost of living. Moreover, using long-differenced estimates they show that, contrary to Glaeser and Marè (2001), workers in metropolitan areas exhibit no more wage growth than workers in non-metropolitan areas, since the dummy for the stayers in metropolitan areas is not significantly different from the dummy for the stayers in non-metropolitan areas. He then develops a spatial equilibrium model consistent with these empirical patterns, pointing out that wage growth effects might arise from workers

learning about their abilities (given the assumption that workers at first are not fully aware of their ability levels, but learn them over time), more than from learning about processes of production.

Finally, Gould (2007) focuses on the identification of the causal urban wage premium and develops a structural model that accounts for the self-selection of workers moving into cities. He shows that cities do not pay an urban wage premium for blue collar workers, while they make white collar workers more productive. He also claims that workers move to cities not only because of a location choice, but also as a form of human capital investment.

All these studies concern the analysis of the determinants of the urban wage premium evaluated at the conditional mean. In our paper we focus on the same topic along the whole wage distribution. Some papers already focused on the urban wage premium and distributional issues. Wheeler (2004) uses aggregate data for the US to show that the 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 increase wage inequality and that the sorting of workers is relevant and not homogeneous along the wage distribution. These studies, however, do not investigate the determinants of the urban wage premium along the wage distribution, disentangling between the wage level and wage growth effects, which is indeed the focus of this paper.

3. Description of the Data and Definition of Spatial Variables

We use a panel version of the Italian administrative database provided by INPS and elaborated by ISFOL.[3] It is an employer-employee dataset, constructed for the period 1986-2003 by merging the INPS employee information with the INPS employer information.[4] The units of the analysis are industrial- (manufacturing and mining) and

[3] The sample scheme of the database follows individuals born on the 10th 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 0.5th (99.5th) 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. This database has been used since 1999, because the

service-dependent workers, both part-time (converted into full-time equivalent) and full-time. We focus on standard labour contracts, including both blue and white collars. Moreover, we take into account prime-age male workers, aged between 25 and 49 (when they first enter the database), as is common practice in this literature (see for instance Topel, 1991, Mion and Naticchioni, 2009).[5] Finally we consider only those workers that are in the dataset for at least three years, in order to get more reliable within estimations. 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. As for the firms, we have the plant location (province), the 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. As a proxy for the urban agglomeration we make use of the employment density variable as defined in Combes (2000), Ciccone and Hall (1996), Mion and Naticchioni (2009) and Matano and Naticchioni (2011). The spatial breakdown is by provinces (*province*), classified in 95 units.[6] The employment density definition is as follow:

$$Dens_{p,t} = ln\left[\frac{empl_{p,t}}{area_{p}}\right]$$

where subscript p refers to the 95 provinces and t to time (province area is measured in square km).

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. 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

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INPS employer database was not available after 1998. The two databases provide the same set of information (firm size and sector).

[5] We do not consider, as standard in this literature, women and young/old 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 labour market outcomes (Topel, 1991).

[6] 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 (1991). 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.

who move, but remain either in a LD or in a HD province are classified as stayers (in LD or HD). Further, if an individual moves more than once between HD and LD provinces, it may "score" more than once in the analysis.[7] Table 1 shows the descriptive statistics for the different workers' groups. As expected, the average wage of stayers in LD provinces are lower than those of stayers in HD provinces, while the average wage for migrants lie in between those of stayers, consistently with Mion and Naticchioni (2009). Migrants are also generally slightly younger than stayers and are relatively more concentrated in white collar occupations. 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 workers' groups in the industry sector.

Table 1: Descriptive Statistics of the Variable of the Analysis

Variable	Mean	Std. Dev.	Min	Max	Mean	Std. Dev.	Min	Max
Stayers Low Density (199,282)					**Stayers High Density (218,804)**			
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 Dummy	0.70	0.46	0	1	0.57	0.50	0	1
White Collar Dummy	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 Dummy	0.22	0.41	0	1	0.52	0.50	0	1
North East Dummy	0.24	0.43	0	1	0.23	0.42	0	1
Centre Dummy	0.21	0.41	0	1	0.18	0.39	0	1
South Dummy	0.22	0.41	0	1	0.07	0.25	0	1
Island Dummy	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
Movers Low-High Density (19,845)					**Movers High-Low Density (19,869)**			
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 Dummy	0.54	0.50	0	1	0.54	0.50	0	1
White Collar Dummy	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 Dummy	0.34	0.47	0	1	0.37	0.48	0	1
North East Dummy	0.25	0.43	0	1	0.24	0.43	0	1
Centre Dummy	0.21	0.41	0	1	0.19	0.40	0	1
South Dummy	0.14	0.35	0	1	0.16	0.36	0	1
Island Dummy	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.

[7] We did not consider workers moving three times between LD and HD and vice versa, who anyway account for a very small fraction of workers in the sample.

4. Empirical Analysis

4.1 Disentangling the Wage Level Effect and the Wage Growth Effect along the Wage Distribution.

In this section we use a quantile regression approach to examine the relevance of the wage level effect and the wage growth effect in determining the urban wage premium. Following Glaeser and Marè (2001), we estimate a wage regression with dummies that capture the exact path of migration:

$$\ln(w_{i,t}) = \alpha_\theta + B'_\theta * I\_Char_{i,t} + \beta_\theta * Firmsize_{i,t} + \sum_j \gamma_j^{l-h} I_{j,t}^{l-h} + \sum_j \gamma_j^{h-l} I_{j,t}^{h-l} + \varphi_{s,\theta} + \lambda_{a,\theta} + \delta_{t,\theta} + \varepsilon_{i,t,\theta}$$

where θ refers to the percentile, i to individuals, s to sectors, p to provinces, t to time and j stands for the dummies concerning time intervals before ("10 to 5", "4 to 3", "2 to 1"), after ("1 to 2", "3 to 4", "5 to 10") and for the migration year ("0")), with $j \in T_i$ (individual time span).

The dependent variable in our regressions is the (log) real gross weekly wage in euro.[8] As for the variables of interest, the $I_{j,t}^{l-h}$ (with j=(-10-5,…,+5-+10)) stand for dummy variables that take on a value of one when the worker, at time *t*, has moved (will move) *j* years before (after) from a low to a high density province, while $I_{j,t}^{h-l}$ stand for dummy variables that take on a value of one if the worker, at time *t*, has moved (will move) *j* years before (after) from a high density to a low density province. Hence, the estimates of γ_j^{l-h} and γ_j^{h-t} reflect the extent to which wage changes before or after a move. When using standard quantile regression, the omitted category in the migration dummies is the stayers in LD provinces. We also report the coefficients for the stayers in HD provinces.[9]

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

[8] 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.

[9] It is worth noting that in our sample we consider only workers where location data are continuosly available (i.e. data are available for consecutive years), since when data are missing for some years it is not possible to establish the pattern of worker's career. Moreover, we do not consider migrants before and after ten years from migration.

firm heterogeneity[10], while φ_s, λ_a, δ_t are sectoral, 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. First of all, it is worth noting that non-movers in HD provinces earn significantly more than non-movers in LD provinces. This confirms that the bulk of wage differences across the space dimension is mainly due to the stayers (Mion and Naticchioni, 2009). Moreover, the urban wage premium for stayers in HD with respect to those in LD increases along the wage distribution, passing from 2.3% at the bottom of the wage distribution to 5.8% at the top, meaning that high skilled workers have a greater advantage in working in HD areas consistently with Matano and Naticchioni (2011).[11]

As for the migrants, taking into account the movers from LD to HD provinces it is possible to note that, consistently with Glaeser and Marè (2001), at the median a large amount of the urban wage premium arises some years after the migration (Table 2). However, different patterns emerge when the whole wage distribution is taken into account. On the one hand, just after the migration, workers at the bottom of the wage distribution (10th percentile) turn out to be penalized compared to workers who remain in LD provinces (wages are lower of 7.2%). However, in the years following the migration wages tend to rise and after 3-4 years they earn significantly more than workers in LD provinces (+1.7%); the premium increases further after 5-10 years (+5.4%). This result is in line with the wage growth hypothesis. The total urban wage premium, defined in this paper as the difference in coefficients between 1-2 years before the migration and 5-10 years after migration, turns out to be of a magnitude of 9% for unskilled workers proxied by the 10th percentile.

As for high skilled workers, the pattern is rather different. In fact, just after the migration they earn significantly more than stayers in LD provinces (+6% at the 90th percentile). Further, compared with the years just before the migration, the urban wage premium is higher by 2.2%, consistently with the wage effect hypothesis. This finding suggests that for high skilled workers there seems to be a more important role for agglomeration economies in determining the urban wage premium, in line with Matano and Naticchioni (2011). At the same time, there is also evidence of a wage growth effect since the urban wage premium tends to increase over time: the total

[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).

[11] It is worth noting that this urban wage premium is present also after controlling for the firm size, i.e. after taking into account that part of the urban wage premium related to the firm size (Lehmer and Moller, 2010).

urban wage premium is 16% (20% after 10 years compared to 4% just before the migration), higher than the one for low skilled workers.

These findings underline that while for the less skilled workers the determinant of the urban wage premium appears to be due to a wage growth effect, for the high skilled workers the urban wage premium is the result of both a wage growth and a wage level effect.

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 at the time of migration relative to 1-2 years before, consistently with the wage growth hypothesis (in line with Glaeser and Marè, 2001). Rather, in some cases there is also a slight increase (1-2%).

Table 2: Analysis of the Wage Growth and Wage Level Hypothesis. Quantile Regression. Dependent Variable: Log of Real Weekly Wage.

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

However, all these estimates could overestimate the amount of the urban wage premium since they do not take into account the role of the sorting of workers. In fact skilled workers can concentrate in cities for different reasons: living in cities offers opportunities to enjoy a wide range of amenities such as cultural activities, events, museums, etc., which attract skilled workers; return to education (both private and social) is generally higher in cities (Moretti, 2004) and human capital accumulation is faster (Glaeser and Maré, 2001, Glaeser and Resseger, 2010). This means that part of the

wage premium imputed to agglomeration economies, as well as human capital accumulation and quality matching, could actually be due to the sorting of skilled workers into cities. In order to tackle this issue, we perform quantile fixed effects estimates that allow taking into account the individual unobserved heterogeneity.

As methodology we use the techniques developed by Canay (2011) and Koenker (2004). These two procedures provide very similar results (Table 3 and 4).[12] We comment the estimates of Table 3. The omitted category within each group of migrants is the category '5 or more years before the migration'. This means that now the dummies' coefficients describe the difference in wages with respect to this category.

Results in table 3 confirm that sorting matters. In particular, considering the movers from LD to HD provinces, the percentage difference in coefficients between 1-2 years before a move and 5-10 years after a move generally decreases with respect to previous estimates, and the reduction is higher at the highest percentiles. The total urban wage premium for workers at the 10th percentile is now around 7%, 2 percentage points lower than in cross sectional estimates. At the 90th percentile, this is equal to 5%, 11 percentage points lower than in cross sectional estimates. This confirms that when taking into account the sorting of workers, the extent of the urban wage premium strongly decreases (as in Combes et al., 2008, Mion and Naticchioni, 2009, Matano and Naticchioni, 2011, Yankow, 2006, Kim, 2004). Further, the total urban wage premium is now more similar across workers' percentiles. However, it is worth noting that if we consider the urban wage premiums from '5 and more years before the migration' to '5 and more years after the migration', it is again the high skilled workers who enjoy the highest wage premium. In fact, these equal around 8% at the 90th percentile, 5.5% at the median and 3.7% at the 10th percentile. This difference is due to the fact that low skilled workers (10th percentile) are characterized by a reduction in the wage premium during the years before the migration relative to 5 and more years before the migration.

[12] 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 and proofs.

Table 3: Analysis of the Wage Growth and Wage Level Hypothesis. Quantile Fixed Effects Regression (Canay, 2011). Dependent Variable: Log of Real Weekly Wage.

	q10	q25	q50	q75	q90
Non movers living in a High Density Province	-	-	-	-	-
Moving to a HD province:					
Observed 5 or more years before a move	-	-	-	-	-
Observed 3-4 years before a move	-0.030***	-0,003	0,003	0.005**	0.020***
	[0.007]	[0.003]	[0.002]	[0.002]	[0.005]
Observed 1-2 years before a move	-0.063***	-0.024***	-0.011***	0.005*	0.032***
	[0.007]	[0.003]	[0.001]	[0.003]	[0.004]
Observed within a year after a move	-0.042***	-0.009***	0.007***	0.034***	0.071***
	[0.007]	[0.003]	[0.003]	[0.003]	[0.008]
Observed 1-2 years after a move	0.012***	0.018***	0.031***	0.050***	0.072***
	[0.004]	[0.002]	[0.002]	[0.003]	[0.006]
Observed 3-4 years after a move	0.031***	0.033***	0.043***	0.056***	0.075***
	[0.005]	[0.002]	[0.003]	[0.005]	[0.009]
Observed 5 years after a move	0.037***	0.039***	0.055***	0.069***	0.080***
	[0.006]	[0.003]	[0.002]	[0.003]	[0.005]
Moving to a LD province:					
Observed 5 or more years before a move	-	-	-	-	-
Observed 3-4 years before a move	-0.019***	0,001	0.016***	0.029***	0.051***
	[0.005]	[0.005]	[0.003]	[0.003]	[0.006]
Observed 1-2 years before a move	-0.029***	0.006*	0.030***	0.052***	0.091***
	[0.007]	[0.003]	[0.002]	[0.002]	[0.007]
Observed within a year after a move	-0.050***	0,005	0.036***	0.057***	0.101***
	[0.010]	[0.006]	[0.004]	[0.005]	[0.010]
Observed 1-2 years after a move	0,003	0.033***	0.048***	0.065***	0.082***
	[0.003]	[0.003]	[0.002]	[0.003]	[0.006]
Observed 3-4 years after a move	0.031***	0.049***	0.054***	0.065***	0.082***
	[0.007]	[0.004]	[0.003]	[0.006]	[0.008]
Observed 5 years after a move	0.030***	0.039***	0.048***	0.061***	0.082***
	[0.004]	[0.002]	[0.002]	[0.003]	[0.006]
N. of Observations	457.800	457.800	457.800	457.800	457.800
N. of Individuals	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: Analysis of the Wage Growth and Wage Level Hypothesis. Quantile Fixed Effects Regression (Koenker, 2004). Dependent Variable: Log of Real Weekly Wage.

	q10	q25	q50	q75	q90
Non movers living in a High Density Province	-	-	-	-	-
Moving to a HD province:					
Observed 5 or more years before a move	-	-	-	-	-
Observed 3-4 years before a move	-0.023	-0,001	0,002	0,001	0,003
	[0.018]	[0.005]	[0.004]	[0.005]	[0.006]
Observed 1-2 years before a move	-0.066***	-0.022***	-0,01	0,005	0.031***
	[0.019]	[0.008]	[0.006]	[0.006]	[0.012]
Observed within a year after a move	-0.049***	-0,009	0,008	0.032***	0.065***
	[0.013]	[0.010]	[0.007]	[0.008]	[0.012]
Observed 1-2 years after a move	0,011	0,017	0.027***	0.040***	0.057***
	[0.011]	[0.011]	[0.007]	[0.010]	[0.015]
Observed 3-4 years after a move	0.026**	0.032***	0.038***	0.048***	0.062***
	[0.011]	[0.008]	[0.008]	[0.010]	[0.013]
Observed 5 years after a move	0.042***	0.041***	0.053***	0.065***	0.080***
	[0.010]	[0.010]	[0.009]	[0.010]	[0.017]
Moving to a LD province:					
Observed 5 or more years before a move	-	-	-	-	-
Observed 3-4 years before a move	-0,021	-0.004	0.012**	0.023***	0.039***
	[0.017]	[0.011]	[0.005]	[0.007]	[0.015]
Observed 1-2 years before a move	-0.041***	0,002	0.028***	0.050***	0.083***
	[0.015]	[0.012]	[0.006]	[0.009]	[0.011]
Observed within a year after a move	-0.056**	0,006	0.036***	0.056***	0.088***
	[0.023]	[0.013]	[0.007]	[0.008]	[0.012]
Observed 1-2 years after a move	0,005	0.037***	0.049***	0.060***	0.075***
	[0.027]	[0.010]	[0.007]	[0.012]	[0.013]
Observed 3-4 years after a move	0.041***	0.051***	0.055***	0.059***	0.077***
	[0.010]	[0.008]	[0.008]	[0.009]	[0.014]
Observed 5 years after a move	0.039**	0.048***	0.053***	0.062***	0.073***
	[0.016]	[0.010]	[0.009]	[0.011]	[0.014]
N. of Observations	457.800	457.800	457.800	457.800	457.800
N. of Individuals	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.

In terms of the decomposition between the wage growth and wage level effect, fixed effects estimates show that most of the urban wage premium is due to a wage level effect for skilled workers at the 90th percentile (around 4% wage increase due to the migration) than to a growth level effect (an additional 1% of wage increase). On the contrary, for the low skilled workers the wage premium is essentially due to a wage growth effect: there is just a slight increase immediately after migration (+2%), while the rest of the urban wage premium comes out over time (+5%).

As for the migrants from HD to LD provinces, fixed effects estimates generally confirm cross sectional results. In particular there is no evidence of wage losses at the time of migration from the median up to the 90th percentile (consistently with the wage growth hypothesis), while there is a 1-2% points reduction for the lowest percentiles.[13]

4.2 Disentangling the "Learning" and the "Coordination" Effects along the Wage Distribution

We have seen in the previous subsection that part of the urban wage premium is in general related to a wage growth effect, which is higher for unskilled workers. The wage growth effect could be the outcome of either faster human capital accumulation (learning) or more efficient job searching and matching (coordination). In this section we want to analyze the determinants of the wage growth that occurs after the migration by examining the role of the "learning" and "coordination" effects. We focus on the migrants from LD to HD provinces, once moved into HD provinces. We perform fixed effects quantile regressions including variables that are usually considered as proxy for the "within" jobs wage growth (tenure) and the "between" jobs wage growth (dummy for job change). 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 θ 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 for the 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. We report in Table 5 the estimates derived by means of the fixed effect quantile regression methodology developed by Canay (2011).

[13] We also run a robustness check where, in order to focus only on relevant migrations, we perform the same analysis by splitting the density distribution in terciles and we consider as movers from LD to HD provinces only the migrants who pass from a LD province below the 33rd percentile of the province's density distribution to a HD province above the 66th percentile of the province's density distribution. The results widely confirm previous findings. Low skilled workers still enjoy a higher wage premium over time, while for high skilled workers the increase in wages due to agglomeration economies (wage level effect) and to 'learning' and 'matching' mechanisms (wage growth effect) is now more uniform. We do not show these estimates for a sake of synthesis. They are available upon request.

After having taken into account also the unobserved individual heterogeneity, the impact of "within" and "between" jobs components on wages is not uniform along the wage distribution. In fact, the wage growth of unskilled workers is due to a positive and significant impact of the tenure, while the returns to tenure decrease along the wage distribution. This evidence points out that for unskilled workers is the accumulation over time of human capital that plays a substantial role in generating the wage growth previously detected.

Table 5: Quantile Fixed Effects Estimates (Canay, 2011) of the Impact of Job Tenure and Job changes on Wages. Sample: Migrants from Low to High Density Provinces after the Migration.

	q10	q25	q50	q75	q90
Job-to-Job	-0.036***	-0.022***	-0.008**	0.008	0.029**
	[0.013]	[0.004]	[0.004]	[0.007]	[0.012]
Tenure	0.014***	0.004**	0	-0.004***	-0.011***
	[0.004]	[0.002]	[0.001]	[0.001]	[0.003]
Tenure squared	-0.002***	-0.001***	0	0.001***	0.001***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Age	0.077***	0.070***	0.066***	0.065***	0.060***
	[0.005]	[0.002]	[0.001]	[0.001]	[0.004]
Age squared	-0.001***	-0.001***	-0.001***	-0.000***	-0.000***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Firm Size	0.011***	0.011***	0.010***	0.010***	0.010***
	[0.001]	[0.001]	[0.001]	[0.001]	[0.001]
Blue Collar Dummy	-0.132***	-0.125***	-0.128***	-0.130***	-0.135***
	[0.006]	[0.003]	[0.002]	[0.004]	[0.005]
Constant	3.929***	4.165***	4.331***	4.432***	4.575***
	[0.118]	[0.050]	[0.042]	[0.032]	[0.105]
N. of Observations	8,675	8,675	8,675	8,675	8,675
N. of Individuals	1,743	1,743	1,743	1,743	1,743

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

As for the impact of job changes, this is positive and significant for high skilled workers, suggesting better matching opportunities in dense area (consistently with Yankow 2006 and Wheeler 2006). Further, when comparing these impacts with those of the workers who did not migrate and remain in LD provinces (Table 6), it comes out that that while the return to tenure is substantially similar across migrants and stayers, the return to job changes is higher for workers who migrate in HD provinces (semielasticities: 2.9 vs. 2.3). Moreover, it is worth noting that the cumulative effect of wage growth due to job changes is probably even higher since the incidence of job changes for the group of migrants towards HD provinces is relatively higher than the

one for the stayers in LD provinces (11% vs. 8.8%).[14] This raw difference in probability of having a job change is also confirmed by using a probit model where migrants show a significantly higher probability of changing jobs than stayers (table 7). This is consistent with the findings of Yankow (2006) who shows that the total cumulative between wage growth is widely driven by a high incidence of between job changes within metropolitan areas.

Table 6: Quantile Fixed Effects Estimates (Canay, 2011) of the Impact of Job Tenure and Job changes on Wages. Sample: Stayers in Low Density Provinces

	q10	q25	q50	q75	q90
Job-to-Job	-0.024***	-0.012***	0.000	0.011***	0.023***
	[0.004]	[0.002]	[0.001]	[0.002]	[0.002]
Tenure	0.015***	0.008***	0.004***	0.001***	-0.003***
	[0.001]	[0.000]	[0.000]	[0.000]	[0.001]
Tenure squared	-0.001***	-0.000***	-0.000***	0.000	0.000***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Age	0.042***	0.035***	0.032***	0.029***	0.025***
	[0.001]	[0.000]	[0.000]	[0.000]	[0.001]
Age squared	-0.000***	-0.000***	-0.000***	-0.000***	-0.000***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Firm Size	0.022***	0.020***	0.019***	0.017***	0.015***
	[0.000]	[0.000]	[0.000]	[0.000]	[0.000]
Blue Collar Dummy	-0.060***	-0.068***	-0.073***	-0.081***	-0.099***
	[0.001]	[0.000]	[0.000]	[0.001]	[0.001]
Constant	4.572***	4.851***	4.993***	5.140***	5.336***
	[0.016]	[0.007]	[0.006]	[0.011]	[0.021]
N. of Observations	199,282	199,282	199,282	199,282	199,282
N. of Individuals	20,062	20,062	20,062	20,062	20,062

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

On the whole these results point out the following interesting findings. First of all, we point out that the patterns of the urban wage premium are far from being homogeneous along the wage distribution. In particular, high skilled workers enjoy higher wage premiums in terms of a wage level effect since most of the urban wage premium arises at the time of migration. Therefore skilled workers are those who benefit more from agglomeration externalities. For low skilled workers we derive opposite patterns, since the wage premium arises after some years following the

[14] The comparison with the sample of all workers shows that the pattern for the return to tenure is similar to previous estimates, while the return to job changes for the high skilled is slightly smaller in the estimates for all the economy. Nonetheless, again, for the entire economy the incidence of job-changes is around 8.6%, which is significantly smaller than the one of the migrants once arrived in the city (11%).

migration. Moreover, the sorting of workers in part explains the urban wage premium. Looking at the relevance of the "learning" and "coordination" effects in determining the wage growth we find out that for unskilled workers the accumulation of human capital is determinant for the wage growth, while for skilled workers is more the quality of the matching between workers and firms that plays a role.

Table 7: Probit model of the likelyhood of changing job. Dependent Variable: Job-to-Job Change	
Stayers LD	-0.103***
	[0.013]
Stayers HD	-0.130***
	[0.013]
Migrants Low-to-High Density in HD	0.654***
	[0.018]
Migrants High-to-Low Density in LD	0.635***
	[0.018]
Constant	-1.246***
	[0.012]
N. of observations	457,800
N. of individuals	46,822

Notes: Standard Errors in Parenthesis with ***,** and * denoting significance at 1%, 5% and 10% respectevely. The reference cateogory is migrants before the migration.

5. Conclusions

In this paper we analyze the role of the agglomeration economies, human capital accumulation and quality matching in determining the urban wage premium along the wage distribution of Italian workers. We want to check whether and how much the determinants of the urban wage premium differ along the wage distribution, a relatively unexplored field within the spatial economics literature. In order to perform such a task we perform quantile fixed effects regressions to take also into account the relevance of the sorting of workers. We derive the following findings. First, our analysis confirms that the sorting of workers is relevant since wage premiums turn out to be reduced when taking into account the unobserved individual heterogeneity. Second, we have uncovered important differences in the determinants of the urban wage premiums between high and low skilled workers. While for high skilled workers an important part of the urban wage premium is due to agglomeration economies and the other part to a better matching between workers and firms in cities, for low skilled workers human capital accumulation plays a major role.

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