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Education, experience, and urban wage premium☆

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ABSTRACT

Cities have higher wages and more college-educated workers than less populated areas. We investigate the heterogeneity of the agglomeration effect and sorting with respect to education. The magnitude of static and dynamic agglomeration effects on wages in Norway is estimated for different educational categories. Using rich administrative data for the period 2003–2010 with experience data back to 1993, we find that college-educated workers have higher return to labor market experience accumulated in cities. The city wage premium of less educated workers is increasing in job tenure, while the college educated gain more from shifting jobs between firms. We address sorting by comparing distributions of worker fixed effects by level of education. The distribution of unobserved abilities is similar in cities and the rest of the country for workers with only primary and secondary education, while the distribution for workers with college education is shifted to the right in cities. Sorting with respect to unobserved abilities matters for college-educated workers, even when taking dynamic learning effects into account. Distinguishing between young and old workers, we find that differences in unobserved abilities are more important early in a worker's career.

1. Introduction

The role that college-educated workers play in the productivity of cities has led to a literature dealing with "skilled cities" or "smart cities" (Glaeser and Saiz, 2004; Shapiro, 2006; Combes et al., 2008; Winters, 2011). The observed urban wage premium is partly explained by the urban concentration of college-educated workers. The studies deal with the static agglomeration effect and the methodological challenge of separating sorting from productivity. Recent contributions apply individual panel data and address the importance of the place and type of experience (Glaeser and Mare, 2001; Gould, 2007; Baum-Snow and Pavan, 2012) and derive dynamic agglomeration effects (De la Roca and Puga, forthcoming; Matano and Naticchioni, 2016). We extend this literature by combining data on experience and education to analyze agglomeration effects and sorting based on unobserved abilities across education groups.

We begin by estimating static and dynamic agglomeration effects for different education groups. City regions with more than 150,000 inhabitants are compared to regions in the rest of the country. Using rich administrative data for Norway for the period 2003–2010 with experience data back to 1993, we find that the initial urban wage premium increases with education level. This is in accordance with the static literature. Our contribution is to study the effects of experience and job tenure across education groups, and we show that college-educated workers have higher return to labor market experience accumulated in cities. The city wage premium of less educated workers is increasing in job tenure, while the college educated gain more from shifting jobs between firms. Furthermore, we address sorting by comparing distributions of worker fixed effects by level of education. The distribution of unobserved abilities is similar in cities and the rest of the country for workers with only primary and secondary education, while the distribution for workers with college education is shifted to the right in cities. Sorting with respect to unobserved abilities matters for college-educated workers, even when taking dynamic learning effects into account. Distinguishing between young and old workers, we find that differences in unobserved abilities are more important early in a worker's career.

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Only a limited number of studies of agglomeration effects have individual data on education achievement, and they do not use worker fixed effects to identify the agglomeration effect. The existing analyses basically conclude that static agglomeration effects are higher for those with the highest education level. Wheeler (2001) shows how, in the United States, the effect is increasing with the level of education. Rosenthal and Strange (2008) find that the urban wage premium for workers with college degrees is higher than for other workers. Bacolod et al. (2009) conclude that the effect of population size increases monotonically with education level, although the difference in effect between workers with college and high school degrees is not statistically significant. Exceptions include Adamson et al. (2004), who find a nonlinear relationship between urban wage premium and education level, and Di Addario and Patacchini (2008), who find a negative correlation between return to higher education and regional population size. We consider identification when allowing for worker fixed effects and study how dynamic agglomeration effects vary across education groups.

Recent studies look at the importance of work experience in more detail. The analyses relate to a large empirical labor literature on the returns to experience, seniority, and job tenure, initiated by Topel (1991). Baum-Snow and Pavan (2012) offer model simulations separating between a wage level effect and variation in the return to experience across cities and abilities. They find that for college-educated workers living in large cities, the work experience effect is more important. De la Roca and Puga (forthcoming) use register data from Spain to estimate the urban wage premium with identification based on movers, including the individual history of experience. They find that working in a larger city gives an immediate wage premium that is expanded over time when working in a large city. De la Roca (2011) looks at both initial and return migration. D'Costa and Overman (2014) show that workers with experience in cities have higher wage growth. Matano and Naticchioni (2016), using panel data for Italian workers, find that return to work experience in high-density regions is increasing over the wage distribution.

In addition to spatial sorting with respect to observable characteristics, the recent research also addresses sorting based on unobserved abilities using worker fixed effects. The methodology of testing for shift, dilation, and truncation when comparing distributions of worker fixed effects across locations is developed by Combes et al. (2012a). Combes et al. (2012b) document sorting with respect to unobserved abilities in a static model, while De la Roca and Puga (forthcoming) argue that sorting disappears when the value of experience is allowed to vary across city sizes. We study the heterogeneity of sorting within different educational categories.

The administrative register data cover hourly wages of the whole working population during 2003 to 2010, and include information about work experience dating back to 1993. We exclude part-time workers and workers in the public and primary sectors, producing a dataset with about 4.1 million worker-year observations in 54 industrial sectors, 350 occupations, 89 labor market regions, and about 140,000 firms. The main analysis focuses on the city wage premium in the largest city labor market regions in Norway, defined as having more than 150,000 inhabitants in 2010 and denoted as “cities”. In our analyses we distinguish between Oslo and the six other large cities. Compared to regions outside the largest seven cities, Oslo's raw wage premium is 18.7%—reduced to 10.8% when controlling for observed worker characteristics, and 6.5% when including worker fixed effects. Alternative cutoffs defining cities are investigated, and a separate analysis uses a continuous population density variable. We study how the city wage premium and return to work experience and job tenure in cities depend on education level after controlling for industry, occupation, and unobservable time-invariant worker characteristics.

We find that college-educated workers benefit most from working in cities, and that the extra city wage premium they enjoy over low-educated workers is increasing with city work experience. The combined static and dynamic overall premium in Oslo is 17%, which consists of a static effect of 7% and an experience effect of 10% (at average experience of eight years). Primary-educated workers have a combined premium of 7%, while college-educated workers gain 14% in Oslo. We know of no other studies of the dynamic role of work experience using education data, but our result is consistent with variation across ability levels shown by De la Roca and Puga (forthcoming) and over the wage distribution analyzed by Matano and Naticchioni (2016). We find that the city wage premium of low-educated workers is increasing in job tenure, whereas the premium of college-educated workers is increasing with job shifts. The wage premium for college-educated workers is reduced to 13% in Oslo when we take job tenure into account. Job tenure in cities has a detrimental effect on the wage premium of college-educated workers. The result is in accordance with the analysis of job change for skilled and unskilled workers by Matano and Naticchioni (2016). They identify unskilled workers using percentile of the wage distribution instead of education, and separate between high-density and low-density regions.

We address sorting by comparing distributions of unobserved abilities by level of education. In the aggregate, a static model shows sorting with respect to unobserved abilities consistent with the literature. When we allow the value of experience to differ with city size, we still have sorting, contrary to De la Roca and Puga's findings (forthcoming). The sorting, based on worker fixed effects, is driven by the college educated. The distribution of worker fixed effects is similar in cities and the rest of the country for workers with only primary and secondary education. In an investigation separating between young and old workers, we find sorting only among the young. We begin by reproducing the findings of Combes et al. (2012b) in a static model, and find that sorting is more important in the old worker group. When we control for experience and allow for the value of experience to vary according to city size, the sorting among old workers disappears. Old workers in cities have accumulated more experience, which in turn is more valuable. Our interpretation is that differences in unobserved abilities are more important early in a worker's career.

Many studies of the agglomeration effect use a continuous population density variable, assuming that the effect is linear over an urban scale. Our OLS estimates show an elasticity of about 0.016–0.03, consistent with recent results. The dynamic elasticities increase from 0.026 for primary-educated workers to 0.043 for college-educated workers. Most authors addressing the endogeneity of population density using instrumental variables (IV) conclude that the endogeneity bias is negligible. We apply instruments of population density based on historical mines, as suggested by Leknes (2015). In this case, the IV estimates of density elasticities are somewhat higher than the OLS estimates. The IV-estimated dynamic elasticities vary from 0.041 for primary-educated workers to 0.054 for college-educated workers.

Our analysis extends the empirical evidence about the urban wage premium to a small European country, Norway. Available administrative registers allow for better databases than most studies, in particular for education. Norwegian cities are small by international comparison; the capital, Oslo, has about 600,000 inhabitants. However, the results show that the static city wage premium of Oslo and the six other large cities is comparable to the estimates found in datasets for other countries. D'Costa and Overman (2014) apply a similar cutoff definition of cities for the UK and reach basically the same result. The elasticity of wages with respect to population density has the same magnitude as comparable studies surveyed by Combes and Gobillon (2015).

The rest of the paper is organized as follows: Section 2 discusses our econometric strategy and data. The estimates of the static city wage premium across education groups are presented in Section 3. Section 4 moves on to dynamic agglomeration effects based on variations in returns to work experience and job tenure across locations. Section 5 deals with sorting on unobserved abilities, while Section 6