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Market Thickness and the Early Labor Market Career of University Graduates

- An urban advantage?

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1. INTRODUCTION

The spatial distribution of human capital plays a key role in shaping the long-term geography of jobs, incomes and well-being. Analyses of US and European regions show that highly educated workers are important drivers of regional development in terms of jobs as well as incomes per capita (Glaeser et al. 1995, Simon 1998, Badinger and Tondl 2003, Cheshire and Magrini 2000). Shapiro (2005) reports that a 10 percent increase in a metropolitan region's concentration of workers with a university education leads to a 0.8 percent increase in subsequent employment growth in the US. Moretti and Thulin (2013) use data for Sweden and find a local multiplier in the order of 3 for manufacturing jobs associated with a long university education, i.e. about six times higher than for manufacturing jobs in general. Human capital also consistently comes out as a significant determinant of innovation and technology absorption in local industries and firms (Faggian and McCann 2009a, Andersson and Lööf 2012).

The general trend is indeed that regions that manage to attract and retain human capital prosper whereas others fall behind. Moretti (2012) considers the 'Great Divergence' taking place between regions with high and low concentrations of highly educated individuals to be one of the most important developments in the US economy during the last decades. Understanding the location of human capital is thus a crucial issue.

We focus in this paper on the location of university graduates, i.e. highly educated new labor market entrants. University graduates are important as they embody newly acquired knowledge and skills, and their location choice has a direct influence on the spatial distribution and regional growth of stocks of human capital (Bradley and Taylor 1996). They are also mobile in the sense that they need to make a choice about where to enter the labor market after graduation, and their decisions are not distorted by any cumulated labor market experiences and historical career paths. This allow for better identification of location motives as well as the returns in terms of wage earnings associated with different locations.

We set out to understand the preference of university graduates towards starting to work in large urban regions after graduation. Using data for Sweden, we document a significant concentration of graduates to the country's three major urban regions. Almost two out of three graduates enter employment in large urban regions after graduation. This number is significantly higher than what is motivated by the fraction of graduates that graduate from a university in these regions (which is about 45 percent), and means that the large urban regions are net receivers of graduates educated elsewhere. Their attraction is also higher than what is motivated by the general concentration of workers to these regions (which is about 40 percent). These numbers suggest that understanding the location of university graduates in

Sweden is much about understanding their preference for entering the labor market in the larger urban regions upon graduation.¹

There are various explanations for the concentration of highly educated workers to larger regions. Authors such as Glaeser and Gottlieb (2006) emphasize the variety of consumption amenities (such as pubs, restaurants, theaters, specialty stores, opera houses) offered by larger city regions as a key factor behind these regions' attractiveness for highly skilled workers. In contrast, Scott (2010) as well as Storper and Scott (2009) claim that amenity-based arguments are weak and argue in favor of job availability. In an analysis of Dutch graduates, Venhorst et al. (2011) find support for the 'labor market argument' in that a large labor market is the most important characteristic of those regions that manage to retain graduates from their local universities.

Our analysis takes a 'labor market approach' and emphasizes the advantages of urban regions from the perspective of market thickness for skills. University graduates are a select group that enters the job market for the first time upon graduation, and are likely to place a large value on job availability and early job market career prospects. Large urban cities offer a greater number of jobs associated with university education and also host greater concentrations of skilled workers.² Models of the efficiency gains of market thickness suggest that these attributes of local labor markets increase matching probabilities (Gan and Li 2004) as well as the expected quality of each match (Hesley and Strange 1990, Kim 1990). University graduates entering the labor market in larger urban cities are thus more likely to find a better job that matches their skills set.

But market thickness for skills does not only imply advantages that accrue to the probability of getting a first quality job. It also influences the long-term reward to human capital and early labor market career development. University graduates with no prior experience of the labor market are likely to have little knowledge of what kind of work and characteristics of employers they have a preference for, or simply what they are good at in working life. For new entrants to the labor market, Topel and Ward (1992) show that the 'typical' path to a stable employer-employee relation is characterized by frequent job switching, and this can be understood as a consequence of a search process for a match of high quality, where match quality is an experience good (Farber 1994).³ Through thicker markets for skills, large urban regions offer better opportunities and lower transactions costs associated with job

¹ The concentration of university graduates to larger urban regions is not unique for Sweden. Costa and Kahn (2000) report an increasing concentration of human capital to large metropolitan areas in the US over the period 1940-1990.

² A main reason for this is that larger cities tend to host a disproportionately large fraction of headquarter functions of industry (Bel and Fageda 2008), knowledge intensive business services (Jacobs 2013) as well as governmental agencies focusing on e.g. qualified investigational work.

³ Such a search process is also in part a process in which the workers 'learn about what they do well' (cf. Wheeler 2006).

switching, and such mobility may be necessary to find a ‘good job’ and advance early in the job market career.⁴ For these reasons, university graduates may thus prefer a large region with a variety of employers and jobs to a small region with a narrower job market even in circumstances when they have job offers in both regions. Not only are the prospects of a first quality job better, but more importantly, the prospects of a good job market career over time rewarding their human capital investments.

We argue that these job-market advantages of large cities are an important reason for their attraction of university graduates. In particular, the described benefits of thicker markets for skills should be reflected in higher initial wage earnings as well as higher wage growth during the early job market career for university graduates entering the labor market in large cities. To test these arguments, we study the link between the location choice of university graduates and their subsequent wage growth and labor market activity in their early career. The empirical analysis makes use of a unique and detailed individual-level panel dataset on university graduates in the year 2000 from all universities in Sweden. Every graduate in 2000 is followed during their first nine years on the labor market (2001-2009). We assess location choice of university graduates and how initial wages, wage growth as well as rates of job switching relate to their location choice subsequent graduation, while accounting for observed and unobserved individual characteristics.

We show that there is a strong preference of moving to one of the country’s metropolitan regions after graduation. University graduates that enter the job market in large cities after graduation are a select group, and appear to be more motivated as judged by their high-school grades. They also tend to come from families with stronger education traditions as evidenced by the educational background of their parents. University graduates entering large urban regions also get a significantly higher reward to their human capital and a stronger early job market career. The initial wage premium of university graduates starting to work in the large urban regions of Sweden (Stockholm, Gothenburg and Malmö) is in the order of 6–8 percent and is robust to the inclusion of several controls at the level of the individual and the employer. Fixed effects estimations that account for unobserved abilities show that graduates that move to an urban region during their early labor market career obtain a level-effect on the wage of 3–5 percent. We find robust results showing that those university graduates that enter the large urban regions and remain there during our sample period (8 years) show substantially better career development compared to both stayers in other types of regions and movers between regions. After controlling for their initial wage and several other factors, including high-school grades and family background that may proxy for motivation, they show a faster wage growth – the wage growth

⁴ Arguments are also made that information about job openings are better in urban and denser regions. Granovetter (1995) analyses how information about job opportunities is secured and disseminated, and shows that personal networks are an important source of information about jobs. Such networks may be assumed to be wider and grow faster in large urban regions with higher density of people (Finney and Kohlhase 2008).

premium is about 3 percent. The faster wage growth is also associated with a higher rate of job switching. Our results lend strong support for that thicker markets for skills, which improves matching and the early job market career prospects, is a key reason for the concentration of university graduates to larger cities.

The rest of the paper is organized as follows: Section 2 discusses previous literature and theoretical perspectives on the location of university graduates. Section 3 presents the data, defines variables and provides descriptive statistics. The general patterns as regards location, wages and job switching among our sample of university graduates are presented in Section 4. Section 5 presents the empirical strategy and our results. Section 6 concludes.

2. THICK MARKETS FOR SKILLS, CITY SIZE AND CAREER OPPORTUNITIES OF UNIVERSITY GRADUATES

Why do university graduates show a strong preference for entering the job market in large cities subsequent graduation? There are several explanations put forth in the literature. The two major strands of literature either emphasize consumption amenities (Glaeser and Gottlieb 2006) or job availability (Storper and Scott 2009). The first argument concerns that skilled individuals choose to locate in regions where there are amenities such as an abundance of pubs, restaurants and access to fine arts. The counter-argument by authors such as Storper and Scott (2009) is that these amenities only exist because individuals have already chosen to locate there, thus creating a market for these amenities, and that there consequently must be some other factors behind the concentration of workers to big cities. In lieu, economies of scale in production and advantages of thick markets are considered to drive the urbanization process in providing a diverse labor market for the highly skilled, where new sectors are able to provide growth potential (and jobs) if the dominating sectors decline. In short, individuals locate where the jobs are.

Some evidence in favor of this ‘labor market argument’ is provided by Venhorst et al. (2011) for the Netherlands who find support for that a large labor market is the most important characteristic of those regions that manage to retain graduates from their local universities. In addition, Faggian and McCann (2006, 2009a) find that only some types of higher education institutions are efficient in retaining their graduates in the region and that this is largely dependent on the overall labor market characteristics in the surrounding region. Thus, recent graduates tend to enter into employment where there is an abundance of jobs rather than an abundance of amenities, although density of amenities typically goes hand in hand with density of jobs.

In the Swedish context, there is also recent evidence supporting job-related arguments. Using survey and register data, Niedomysl and Hansen (2010) find that jobs rather than amenities are more important for recent university graduates' mobility decision. Furthermore, in a survey of 2000 highly educated people belonging to a Swedish career network conducted by 4Potentials (a Swedish consultancy bureau), it is shown that job opportunities, availability of more qualified positions within firms and the availability of working internationally are primary reasons for location decisions. Amenities were only considered secondary.

Another job-related reason for the increased urbanization of the highly educated is associated to the increase in highly educated female professionals over the recent decades. Costa and Kahn (2000) argue that the major driver for highly skilled couples to locate in metropolitan areas is the prevalence of a diverse and large labor market where both partners in a dual career household (deemed "power couples" when married to one another) can find suitable jobs. This colocation problem is something that a large part of the literature on the urban wage premium neglects since their data is often limited to (white) males with diverse labor market experiences (cf. Glaeser and Maré 2001, Yankow 2006, Wheeler 2006, Topel and Ward 1992).⁵ The analyses that follow include all university graduates, male as well as female, and we have partnership information including the education level of the partner.

A common observation is that areas with a high concentration of human capital provide higher wages, i.e. a so-called urban wage (or productivity) premium which may influence the localization decision of recent graduates if they locate where their education gets rewarded. Studies on the urban wage premium have generally found a nominal wage premium of 2–6 percent for workers locating in dense urban areas (Glaeser and Maré 2001, Yankow 2006, Wheeler 2006 for the US, Lehmer and Möller 2010 for Germany, Matano and Naticchioni 2012 for Italy). These spatial disparities in wages occur due to differences in skills across regions (Combes et al. 2008) where non-routine, highly skilled-relevant tasks locate in urban areas and routine and capital-intensive tasks are located in smaller regions (Scott 2010). However, some evidence points to that this urban premium is not universal, but rather that it primarily pertains to workers with cognitive and people skills, or more generally non-routine skills (Bacolod, Blum and Strange 2009, Andersson et al. 2013).

One source of the urban wage premium is that larger cities offer thicker markets for skills. Gan and Li (2004) show that the probability of a match on the job market increases in the number of firms and

⁵ Although these authors give plausible reasons for this omission (lack of suitable data and potentially different prospects due to child-bearing), they still omit a large fraction of the population as well as confound the micro-foundations for the observed decision if the location-decisions of some skilled males are entwined with the decisions of their spouses.

worker candidates.⁶ In the model by Hesley and Strange (1990), agents are heterogeneous and have imperfect information, and they choose a city knowing the number of other agents in the city (but not their characteristics). The model predicts higher expected quality of the match between job requirements and skills, which lead to a positive relationship between worker wages, productivity and city size. Indeed, Duranton and Puga (2004) maintain that one family of micro-foundations for agglomeration economies, i.e. local interactions between workers and firms that stimulate productivity, is matching. For university graduates initiating a labor market career, these properties of thick markets for skills are likely to be of crucial importance in their location decision. It influences the likelihood of getting a quality job as well as the pay.

The literature on the urban wage premium also documents a “growth” effect which takes place over time. This growth effect can reflect human capital externalities or matching efficiency over time in the sense that workers learn what they do well and switch jobs until they find a good match between job requirements, employer characteristics and their skill set and preferences. Topel and Ward (1992) found that a large share of the wage increase early in the labor market career was due to new workers changing jobs more often which is consistent with the matching argument in labor economics, where a good match signals higher productivity and higher wages. The uncertainty surrounding new entrants on the labor market diminishes with time leading to stable employment. Moreover, this finding is in line with studies on the urban wage premium that generally find that individuals in thicker labor markets change jobs more frequently than their more rural counterparts, which is one source of the larger wage increases for urban workers (Yankow 2006, Wheeler 2006). This matching efficiency is furthermore found to be higher for skilled workers (Matano and Naticchiono 2012), which may be explained by that education enhances worker specialization. In line with this, Andersson and Thulin (2013) find that the marginal effect of spatial employment density on the rate of inter-firm job switching is considerably higher for better educated workers. The faster observed wage growth of cities thus partly emanates from greater possibilities, and willingness, of skilled workers to change jobs that improve matching processes on the labor market. These effects are essentially linked to the internal labor market characteristics of larger city regions.

Based on these arguments, university graduates entering the labor market in larger cities upon graduation are expected to show higher initial wages as well as higher wage growth associated with more frequent job switching, reflecting advantages of thick markets for skills such as a more efficient matching processes and early job market career development. In fact, for in particular skilled workers such as university graduates, a move to a big city may be considered an investment for a long-term reward on human capital.

⁶ To be precise they show that a market with 5 job openings and 5 candidates have much lower matching probability than a market with 50 openings and 50 candidates.

A higher pay and wage development in cities can also influence the perceived job satisfaction as well as the long-term aspiration levels of university graduates. Several studies (Clark 2001, Grund and Sliwka 2007, Freeman 1978) point to the fact that job satisfaction is linked to the nominal reward associated with a job. Clark (2001) studies which aspects of job satisfaction are most important in explaining why quits occur in the UK and shows that the salary and the work itself are the two most important variables in determining this. As a result, the higher level of (nominal) wages in cities could in itself be an attractor of university graduates. Furthermore, higher rates of job switching associated with wage increases would then increase workers' job and career satisfaction. But if utility is derived from wages and these reflect worker productivity and effort, then in order for a worker to maintain the same utility over the life cycle, effort levels have to increase. This further implies that "... employees who receive large wage increases or promotions early in their careers form higher reference points (aspiration levels). Hence, they work harder than do workers without these early successes in their occupational careers to keep up with such a standard. This should in turn lead again to quicker promotions, and so on" (Grund and Sliwka 2007, p. 331). The result is that aspirations are endogenous to the early job market career development. University graduates that enter large city regions and get a quicker wage growth and career development, for instance through more frequent job switching, reach higher levels of job satisfaction and form higher aspirations for their job market career. This would further reinforce the value of operating in an environment with density of qualified jobs.

3. DATA, VARIABLES AND DESCRIPTIVES

3.1 Description of data

Our basic dataset is drawn from the Swedish full population register database maintained by Statistics Sweden, which consists of the entire Swedish population aged 16 and over.⁷ The full set of university graduates comprises 37,699 individuals. We select out all university graduates in the age interval 22–29 years in the year 2000 and that subsequently enter the Swedish labor market in 2001.⁸ We impose a number of restrictions on individual observations, which are described in the Appendix. These leave us with an unbalanced panel dataset consisting of 5,633 university graduates and 33,439 individual-year observations.

The data include several characteristics of the university graduates. First, we have information on innate attributes such as gender, parents' educational level, age, immigration status (first or second generation immigrant), birthplace, place of residence since age 16 as well as information on family formation. Second, the data include characteristics of their educational background such as high

⁷ In essence, the so-called LISA-database.

⁸ Graduates are defined as those that have applied for and been granted a degree.

school grades, educational field at university, location of university studies in terms of both region and specific university. As the data on individuals are linked to employers we can trace the graduates throughout the first years of their labor market career (2001–2009). In every year we have information on employment and from this we can identify individuals' occupational codes, the sector affiliation of the employers and the establishment size of the employers.⁹ By following the individuals over time we are able to derive measures of tenure, job changes as well as shifts in occupation and sector between pairs of years.

3.2 Variables and descriptive statistics

An important variable in our empirical context is the location of the university graduates. Following our focus on labor markets, we identify the location of each graduate by using the location of her workplace. To distinguish between different types of regions we employ a categorization of municipalities developed by analysts at the Swedish Board of Agriculture, in which municipalities are categorized as belonging to a large urban region, city region or the countryside.¹⁰ Only the Stockholm, Gothenburg and Malmö regions qualify as “large urban regions”. University graduates entering large urban regions are thus graduates that start to work in either the Stockholm-, Gothenburg- or Malmö-region. City regions, in principle, consist of medium-sized cities with surrounding small universities. We create dummy variables for large urban regions and city regions, respectively, and use countryside as the reference group throughout the analysis (unless otherwise stated). The dummy variables representing the type of region where the individual has his or her primary workplace each year are thus key variables in the analysis. To measure wages and wage growth we use the total wage income of each graduate during a calendar year.

Table 1 presents basic descriptive statistics of our graduates during the first year in the labor market after graduation. The first two columns refer to the means and standard deviations of all graduates whereas the rest refer to men and women, respectively. The mean initial wage of the graduates is 32,065 EUR.¹¹ The majority of the graduates have a degree in engineering (48 percent), followed by social sciences (41 percent). Most of the graduates enter the private sector (77 percent), of which 58 percent are found in services and 24 percent in manufacturing. About 61 percent work in a multinational enterprise. A small fraction of the graduates have a non-Swedish background – 6 percent

⁹ The workplace that the individual is allocated to during a year is determined by the worker's workplace in the month of November each year. This may understate our measures of inter-firm (or inter-workplace) mobility as we cannot observe the employer in other months (Andersson and Thulin 2013).

¹⁰ Several different criteria are used to categorize municipalities, including in- and out-commuting as a fraction of total employment, percent of populated surface and distance to large city (Swedish Agricultural Board, Report 2009:2).

¹¹ The exchange used is the average exchange rate from February 8th 2012 to February 8th 2013 (1 EUR=8.6792 SEK).

of the graduates are either first or second generation immigrants. 43 percent of the graduates have at least one parent with a university background. In terms of location we see that almost two thirds start to work in any of the large urban regions in Sweden, i.e. Stockholm, Gothenburg and Malmö. An additional 25 percent end up in city regions and the remainder 10 percent enter the labor market in the countryside.

Table 1. Descriptive statistics for graduates in their first year on the labor market after graduation.

<i>Variable</i>	All: 2001		Men: 2001		Women: 2001	
	<i>Mean</i>	<i>Std. Dev.</i>	<i>Mean</i>	<i>Std. Dev.</i>	<i>Mean</i>	<i>Std. Dev.</i>
Wage (in 100 EUR)	320.65	85.84	340.12	90.79	297.95	73.51
Age	26.36	1.46	26.48	1.44	26.22	1.47
Urban regions	0.65	0.48	0.66	0.47	0.64	0.48
City regions	0.25	0.43	0.24	0.43	0.25	0.44
Countryside regions	0.10	0.30	0.10	0.30	0.11	0.31
Social sciences	0.41	0.49	0.28	0.45	0.58	0.49
Natural sciences	0.11	0.31	0.09	0.29	0.12	0.33
Engineering	0.48	0.50	0.63	0.48	0.30	0.46
Married	0.06	0.23	0.05	0.22	0.06	0.24
Average high school grade*	3.77	0.74	3.70	0.71	3.85	0.77
Parent with higher education	0.43	0.50	0.44	0.50	0.43	0.49
Father with higher education	0.30	0.46	0.30	0.46	0.31	0.46
Mother with higher education	0.30	0.46	0.30	0.46	0.29	0.45
Partner with higher education	0.03	0.17	0.03	0.16	0.03	0.17
First-generation immigrant	0.03	0.17	0.02	0.15	0.04	0.19
Second-generation immigrant	0.03	0.16	0.03	0.16	0.03	0.17
Works in multinational enterprise	0.61	0.49	0.67	0.47	0.54	0.50
Private sector	0.77	0.42	0.84	0.37	0.69	0.46
Manufacturing sector	0.24	0.43	0.27	0.45	0.20	0.40
Service sector	0.58	0.49	0.62	0.49	0.55	0.50
Public sector	0.17	0.38	0.11	0.31	0.25	0.43
Establishment size*	595	1,231	656	1,321	524	1,113
Men	0.54	0.50				
# of observations	5,633		3,036		2,597	

Note: The table reports basic descriptive for Swedish university graduates that graduated in 2000 and entered the labor market in 2001. An asterisk implies that the number of observations is somewhat smaller than for the other variables. The exchange used is the average exchange rate from February 8th 2012 to February 8th 2013 (1 EUR=8.6792 SEK).

The above does not differ a lot between men and women with the exception of wages, where men earn approximately 14 percent more than women. There are also some gender differences in the chosen field of education with more males having an engineering background and more females having an educational background in social sciences. Men are also more likely to work in multinational enterprises and in the private sector which partly could explain their higher wages.

In Table A1 in Appendix we also report descriptive statistics for a smaller sample of graduates in 2009, i.e. those graduates that do not have children. As the graduates have nine years of labor market experience in 2009, Table A1 also includes tenure (defined as the number of years the individual has remained at the same workplace since) and the number of different employers between 2001 and 2009. The mean wage has now risen to 57,044 EUR. The spatial distribution of the graduates remains virtually unchanged as compared with the distribution in 2001. The average graduate has 3.6 years of tenure and has had 1.7 jobs. The same differences between men and women that existed in 2001 still exists, i.e. men have higher wages, work in the private sector and in multinational enterprises to a larger extent than women. There are also relatively more men in the sample in 2009 than in 2001 compared to women, reflecting the fact that more women have dropped out of our sample. Having presented the basic patterns in the data we now turn to a deeper look at the location of university graduates and their wage dynamics and labor market mobility.

4. LOCATION, WAGE DYNAMICS AND LABOR MARKET MOBILITY OF UNIVERSITY GRADUATES – an initial description

4.1 Location choice of university graduates

The Swedish economy has been characterized by a strong urbanization process since at least the 1950s and nearly half of all workers in the country work in the one of the three large urban regions. We therefore expect a strong flow of university graduates towards the largest urban regions. But the concentration of graduates to urban regions is significantly higher than what is motivated by the general concentration of economic activity to these regions.

Table 2 reports the percentage of all workers, workers with long university education and the sample of graduates working in different types of regions in 2001 and 2009, respectively.

Table 2. The spatial distribution of different workers in 2001 and 2009, fractions of total (percent).

	All workers		University educated workers		University graduates	
	2001	2009	2001	2009	2001	2009
Large Urban regions	39	40	51	50	65	68
City regions	29	29	29	30	25	23
Countryside	32	30	20	20	10	9

Note: The table reports the fraction of all workers, all workers with a university education of at least three years and our sample of graduates in 2000 that work in different types of regions in 2001 and 2009 respectively.

Almost two thirds of the graduates in our sample enter the labor market in large urban regions, and their spatial distribution remains virtually unchanged over the period 2001–2009. The concentration of graduates to the urban regions is more than twenty percentage points higher than what one could expect based on the spatial distribution of all workers. University educated workers are more concentrated to urban regions (about 50 percent) but not to the same extent as recent graduates. We also observe that a lower fraction of graduates enter in particular the countryside than what one would expect based on their fraction of total employment. City regions have a roughly equal fraction of all workers, educated worker and graduates.

The location choice and the corresponding migration patterns of university graduates may take many forms. Faggian and McCann (2009b) make a distinction between different types of migrants: (i) repeat migrants who come from one region, study in another and then move to a third region to work, (ii) return migrants who return to their region of residence prior to studying after graduation, (iii) university stayers who remain in the university location after studying, but which is not the same as the region where they lived prior to studying, (iv) late migrants who study in the same area as their domicile, but move away after graduation and (v) non-migrants who study and work in the same area as they lived in before. These alternative types of migration behavior represent distinct choices that individuals make, both prior to studying and afterwards.

The migration patterns in 2001 according to the categories above are illustrated in Table 3. We discern that it is most common for university graduates to stay in the same region type throughout the period (non-migrants). 33 percent of all university graduates are from the same type of region in which they studied and start to work. This type behavior is most common among those originating from urban regions. Almost 80 percent of those with urban regions as their home region also studied and start to work in an urban region.

The second most common pattern is that of late migrants, where over about 54 percent of all graduates that studied and came from city regions work elsewhere, predominantly in urban areas. The same fraction for those that studied and came from urban regions is substantially smaller and amount to only 8 percent. Leaving an urban region upon graduation is thus an uncommon migration behavior. Of the about 10 percent of the graduates that start to work in countryside regions, over 60 percent come from such types of regions, i.e. 352 out of 581.

Table 3. Migration patterns of university graduates in 2000.

Home region		Work region		
		<i>Urban regions</i>	<i>City regions</i>	<i>Countryside regions</i>
University region	<i>Urban regions</i>	1,272	66	43
	<i>City regions</i>	433	82	34
	<i>Countryside regions</i>	487	85	65
<i>Urban regions</i>	<i>Urban regions</i>	347	75	18
	<i>City regions</i>	553	578	134
	<i>Countryside regions</i>	568	492	287

Note: The table reports the number of university graduates in 2000 showing a specific migration pattern as judged by the type of region they start to work in in 2001. Home region is defined as the regions in which the university graduates lived at the age of 18. There are no universities in countryside regions.

We can illustrate the attraction of urban regions by looking at the region of labor market entry of graduates that come from the countryside. The largest fraction of the graduates in our sample comes from the countryside, 35 percent or 1,984 in sheer number.¹² Of these, 1,055 (53 percent) start to work in urban regions and another 30 percent in city regions. For graduates coming from city regions (about 32 percent of all graduates), 54 percent start to work in urban regions. The big picture is thus that a majority of the university graduates are attracted to the urban regions for work no matter where they came from previously. This suggests that there is something that attracts them to denser regions in the first place. Urban regions are net receivers of human capital, whereas both city regions and countryside regions are net senders. For instance, city regions deliver 1,814 people that study at universities, they educate 3,052 graduates but they ‘receive’ only 1,378 in the sense of graduates choosing to work there upon graduation.

4.2 Wages, wage growth and job-switching

How are initial wages, wage development and the rate of job-switching of graduates related to their location choice subsequent graduation? The overall pattern that we discern is that university graduates entering urban regions upon graduation show higher initial wage levels on average as well as higher rate of wage growth. Table 4 presents wage levels and wage growth for university graduates by region as well as for male and female university graduates, respectively.

The table shows that the level and growth of nominal wages are higher in urban regions. The mean initial wage in urban regions is around 33,400 EUR, whereas it is 29,750 EUR in city regions and 29,100 EUR in countryside regions. The same pattern emerges for both men and women, initial wages are notably higher in urban regions and do not differ too much between city and countryside regions. Men have a roughly 4,000 EUR advantage over women which may be attributed to the fact that men

¹² Or to be precise; they lived there when they were 18.

work in the private sector, in multinational enterprises and have a degree in engineering to a larger extent than women (see Table 1). We also observe that women have a slightly higher wage growth than men, predominantly in urban regions.

Table 4. Wages in 2001 and wage growth 2001-2009 of university graduates in 2000 by region type.

	All 2001	Wage growth	Men 2001	Wage growth	Women 2001	Wage growth
Urban regions	33,407	8.4%	35,240	8.2%	31,175	8.6%
City regions	29,758	6.8%	31,794	6.4%	27,535	7.1%
Countryside regions	29,095	6.9%	31,070	7.0%	26,995	6.6%

Note: Wage levels are in Euro. The exchange used is the average exchange rate from February 8th 2012 to February 8th 2013 (1 EUR=8.6792 SEK).

Our theory suggests that one source of the higher wage growth of graduates moving to urban regions subsequent graduation is that they show a higher rate of job switching. This higher rate of labor market mobility is in turn often claimed to imply quicker learning about job preferences and skills. Therefore, graduates in urban regions are in a better position to quickly find a good match on the labor market. But do we find higher rates of job switching among graduates in urban regions?

Figure 1 shows the yearly rate of job switching among four groups of graduates. The first category is ‘Movers’ and refers to graduates that move across region types over years. The remainder three categories, i.e. urban, city and countryside regions, refer to graduates that move to each respective type of region and remain there during all years in the sample period. For each respective category, the rate of job switching is measured as the number of graduates that change employer as a fraction of all graduates.

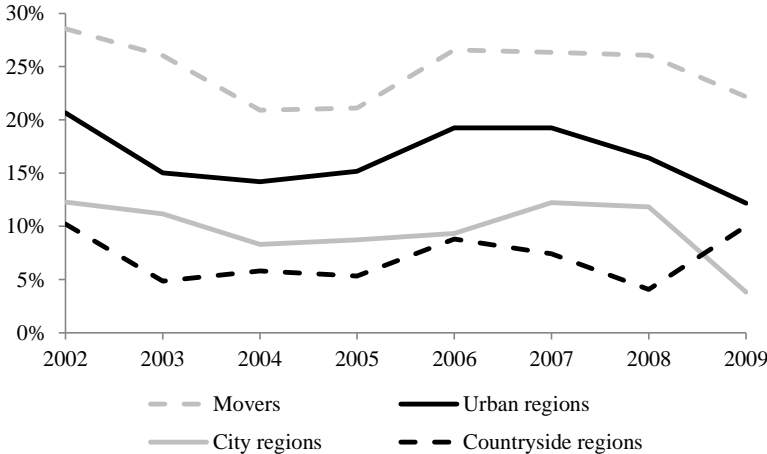


Figure 1. Average rate of job switching for graduates by location behavior subsequent graduation.

Movers are expected to have the highest rate of job switching, as the definition of this category by necessity implies that are mobile. However, we observe significant differences in the rate of job switching between graduates in urban, city and countryside regions. The rate of job switching is between 15–20 percent yearly in urban regions, which is twice as high as the rate of job switching in city and countryside regions. This pattern is consistent with urban regions offering thicker markets for skills and thus better opportunities for job hopping in the early job market career, and may explain the higher wage growth. The small difference in the rates of job switching between city and countryside is also consistent with the rather limited difference in wage growth between the two types of regions. Corresponding graphs for men and women reveal similar patterns.¹³

5. IDENTIFICATION STRATEGY AND RESULTS

5.1 Identification strategy

The main aim of the subsequent analyses is to unravel whether the observed advantages of urban regions in terms of initial wages and wage growth reflect an effect of the urban environment, i.e. thicker market for skills, or if it is simply an artifact of that more able graduates self-select to urban regions. To identify a genuine effect of market thickness, we estimate the influence that entering urban thick labor markets subsequent graduation has on wage levels and wage growth, while controlling for several confounding factors.

We undertake a three-pronged analysis. First, we assess whether university graduates starting to work in urban regions subsequent graduation is a select group. Second, we analyze the influence of location on wage levels. Third, we estimate the influence of location on wage growth. We describe our strategy to identify the effect of location in each set of analysis below.¹⁴

Selection of university graduates to urban regions

Our main hypothesis is that urban regions are attractive primarily because of job- and career-related advantages associated with thick markets for skills. This suggests that university graduates moving to urban regions to enter the job market may be a self-selected group, with greater ambitions and motivations in working life. To test this, we estimate a Probit model with observable individual characteristics as regressors:

$$(1a) \quad \Pr(U_i = 1 | \mathbf{x}_i) = \Phi(\mathbf{x}'_i \Gamma)$$

$$(1b) \quad \mathbf{x}'_i \Gamma = \alpha_i + \mathbf{I}'_i \boldsymbol{\beta} + \sum_{\theta=1}^N \lambda_{\theta} E_{\theta} + \sum_{\sigma=1}^N \delta_{\sigma} H_{\sigma} + \varepsilon_i$$

¹³ Separate figures for men and women are available from the authors upon request.

¹⁴ Table A2 in Appendix defines all variables appearing in the regression analyses.

The dependent variable, U_i , is a dummy variable which is 1 if university graduate i starts to work in an urban region 2001, i.e. the first year on the labor market after graduation, and 0 otherwise. The matrix \mathbf{I} includes individual characteristics reflecting motivation, socio-economic background and marital status. We use high-school grades as a proxy for ability or ambition (cf. Grogger and Eide 1995, Miller 1998, Geiser and Santelices 2007). A large literature shows that workers in urban regions are indeed a select group, such that spatial sorting on (unobserved abilities) explains a large fraction of the general urban wage premium (Combes et al. 2008). High school grades is one observable individual characteristic related to ability and ambition. Socio-economic background is reflected by a dummy which is 1 if any of the parents have a long university education. A general expectation is that individuals with better educated parents are more prone to move to urban regions to gain reward to their human capital, for instance due to support and encouragement from the home environment (cf. Dustmann 2004). We also control for whether the individual is married and whether the partner has a long university education. The latter is intended to reflect the dual labor market career problem, where university graduates with highly educated partners are expected to be more prone to move to larger regions (Costa and Kahn 2000). Descriptive statistics for all these variables are presented in Table 1. Furthermore, we include age and gender. E and H represent dummies for the educational specialization (or field of education) of individual i and the higher educational institution at which individual i studied.

The influence of location on wage levels

The matching advantages associated with thicker markets for skills suggest that the initial wages of university graduates entering the labor market in urban regions should be greater. One reason for this is that the quality of matches increases with the density of employers and employees (Hesley and Strange 1990). To test this we first estimate a simple OLS model for 2001, i.e. the first year in which the university graduates in 2000 are observed on the labor market. The dependent variable is the log of the labor income (wage) in 2001 and our main aim is to estimate the influence of location, which is captured by dummy variables for different types of regions. The baseline model for this is:

$$(2) \quad \ln w_i = \alpha_i + \phi_1 D_i^U + \phi_2 D_i^{CR} + \mathbf{I}'\boldsymbol{\beta} + \mathbf{F}'\boldsymbol{\lambda} + \boldsymbol{\Omega}'\boldsymbol{\theta} + \varepsilon_i$$

where w_i is wage of individual i . D_i^U and D_i^{CR} are dummies for working in an urban region and city region, respectively. The reference group is the countryside. The \mathbf{I} matrix includes individual level controls to capture selection effects. These are age and age squared, dummy for 1st and 2nd generation immigrant, respectively, gender, high school grades and a dummy for whether at least one parent have a long university education. \mathbf{F} represents characteristics of the employer and includes employer size in terms of employees, two-digit NACE sectors dummies, dummy for the private sector as well as a

dummy for whether the employer is a multinational corporation. Ω includes further controls and include occupation dummies at the one-digit ISCO-88 classification system as well as dummies for educational specialization and higher educational institutions. These control variables aim to capture confounding factors and allow for better identification of the effect of location on initial wages.

An issue with the model in (2) is that it is estimated on a cross-sectional dataset as it only pertains to the initial wage in 2001. A large literature show that unobserved time-invariant individual skills have a large influence on estimates of the influence of location on wage, as individuals may sort themselves spatially on such unobserved factors (Combes et al. 2008, Andersson et al. 2013). To further probe our analysis we also exploit the panel structure of the data, and estimate the model in (2) on a panel dataset allowing us to account for worker fixed effects.¹⁵ The within-transformation of this estimator means that we no longer focus on initial wages, but rather the wage level-effect associated with moving to an urban region during the years *after* 2001. Parameters are identified from changes in variables for the same individual over time, which means that parameters for time-invariant variables cannot be estimated. The benefit of this estimator is that we can account for unobserved time-invariant heterogeneity not captured by the controls in the OLS model, and provides a test of the robustness of the results obtained with the simpler OLS model.

Wage growth

A main argument is that the benefits of thick markets for skills do not only pertain to the initial wage, but also to the long-term evolution of wages. Urban regions offer better opportunities for job switching and processes of finding a good match over time on the labor market, and our arguments suggest that this should be reflected in higher wage growth. The estimation model is here given by:

$$(3) \quad \ln\left(\frac{w_{it+1}}{w_{it}}\right) = \alpha_{it} + \rho \ln w_{it} + \phi_1 \hat{D}_i^U + \phi_2 \hat{D}_i^{CR} + \phi_3 \hat{D}_i^{CSR} + \mathbf{I}'_i \boldsymbol{\beta} + \mathbf{F}'_i \boldsymbol{\lambda} + \boldsymbol{\Omega}'_i \boldsymbol{\theta} + \varepsilon_{it}$$

This is essentially the same model as in (2), but with the yearly wage growth as the dependent variable and the wage-level as an additional independent variable. As indicated by the ^-sign, however, the dummies for the different types of regions are here defined somewhat differently than before. \hat{D}_i^U , \hat{D}_i^{CR} and \hat{D}_i^{CSR} denote stayer in urban, city and countryside regions, respectively. They are here 1 for those university graduates that move to the type of region in question and remain there all nine years they are observed. This means that the dummy for urban regions is 1 for university graduates that start to work there in 2001 and continue to work in urban regions all subsequent years. The reference group

¹⁵ We observe the university graduates over a period of nine years.

is ‘movers’, i.e. university graduates that move across region types over years. The reason we do this distinction follows directly from theory.

Theory suggests that working in thicker markets increase wage growth because job switching is cheaper and access to a variety of qualified job positions is better (cf. Finney and Kohlhase 2008, Andersson and Thulin 2013). Match qualities are uncertain ex ante and the quality of a given match may change over time. Because of this, workers engage in search processes towards a quality match in which they also learn about their own job preferences and what they do well (Topel and Ward 1992, Wheeler 2006). These processes should be quicker in regions offering thicker markets for skills and result in higher wage growth. To reap these thick market advantages, however, workers should remain in dense environment during their labor market career.¹⁶ Workers that remain in urban regions all nine years after graduation should show the highest wage growth.

For these reasons we construct location dummy variables that identify workers whose location in a certain type of region is by definition time-invariant, and we employ an OLS estimator to test if university graduates that remain in urban regions show higher wage growth than other workers. With this construction we get four categories of workers: those that remain in either urban regions, city regions or the countryside and a fourth category comprising those workers that move across region types over years. Note that by construction of the location variables, a panel estimator with worker fixed effects is not feasible as this estimator cannot identify parameters of time invariant variables. But in our empirical context, the center of attention is by theoretical arguments on a time-invariant location indicator, rendering a simple OLS estimator our best option. Despite our inability to account for worker fixed effects in these regressions, we try to isolate the effect of location on wage growth by controlling for as many pertinent confounding factors as possible using the rich information in our data.

Sample splits

For all models, we present results for all university graduates as well as for different groups. First, we split the sample between men and women. Many analyses only use data on men, and by running separate regressions for men and women we are in effect allowing the effect of all independent variables to differ depending on gender. This complements the ordinary level-effect provided by the gender dummy when looking at the overall sample, and illuminates the robustness of our results across male and female workers.

¹⁶ Moving away from an urban region to the countryside, for instance, would mean that the thick market effects associated with matching are in all essence lost or reduced.

Second, we also restrict the sample to university graduates that originate from the countryside and did not study at a university located in urban regions. We do this to isolate university graduates that make an active choice of moving upon graduation. In the full sample of all university graduates, we mix graduates that grew up in the urban regions, studied there and simply remained there after graduation. In this sense, they did no major location choice. In the restricted sample of graduates with no observable ties to an urban region prior starting to work, we isolate graduates making a more significant location choice upon graduation.

5.2 Result

Selection into large urban regions – Probit estimates

Table 5 shows the estimated marginal effects that personal characteristics have on the likelihood to start a professional career in a large urban region. Column (1)-(3) present the result for the overall sample and column (4)-(6) the result for those who grew up in the countryside and subsequently moved to a large urban region to start their professional career. The results in the latter three columns are hence based on university graduates making an active choice of moving to a large urban region to start their first job.

Table 5. Selection of graduates to urban regions. Probit regression, dependent variable: 1 = first job in a large urban region.

	<i>Whole sample</i>			<i>Active movers</i>		
	<i>All</i>	<i>Males</i>	<i>Females</i>	<i>All</i>	<i>Males</i>	<i>Females</i>
	(1)	(2)	(3)	(4)	(5)	(6)
Married	-0.149*** (0.043)	-0.167*** (0.064)	-0.134** (0.058)	-0.222*** (0.074)	-0.123 (0.123)	-0.351*** (0.071)
Highly educated parent	0.056*** (0.014)	0.053*** (0.019)	0.054*** (0.021)	0.051* (0.031)	0.003 (0.042)	0.122*** (0.048)
High school grade, logarithm	0.045 (0.056)	-0.007 (0.073)	0.132 (0.088)	-0.075 (0.118)	-0.198 (0.153)	0.081 (0.196)
Age, logarithm	0.301** (0.137)	0.188 (0.186)	0.409** (0.206)	-0.501* (0.273)	0.481 (0.368)	0.249 (0.431)
Male	0.047*** (0.015)	–	–	0.027 (0.032)	–	–
Highly educated partner	0.053 (0.050)	0.060 (0.070)	0.056 (0.072)	0.157 (0.134)	0.037 (0.181)	0.344** (0.174)
# observations	5,327	2,895	2,432	1,280	712	576

Note: The table reports marginal effects of the independent variables. All regressions include dummy variables for university and field of education. Robust standard errors in parentheses. *, ** and *** denote statistical significance at the 10-, 5- and 1-percentage level, respectively. Active movers refer to a restricted sample of university graduates that originate from the countryside and did not study at a university in an urban region.

We find that being married makes it less likely to start the career in a large urban region – the variable is negative in all regressions and highly significant in five out of six regressions. Having a spouse complicates the decision to start working in another location since that decision also affects the job possibilities of the spouse. Moving to another location may hence necessitate two new job opportunities instead of just one for those without a partner. The effect is particularly pronounced for females making an active choice to move to a large urban region while the effect is insignificant for males in a similar situation.¹⁷ Furthermore, the decision to start working in a large urban region after graduation is positively affected by the parents' education. In line with expectations, having highly educated parents increase the likelihood for the graduate to start work life in a large urban region. The effect is highly significant in all regressions except for males that move from the countryside to start their careers in a large urban region. This is consistent with the notion that countryside men are less likely to leave, while typically women from better educated families are more prone to leave for the city. The estimated marginal effect of having a highly educated partner on the decision to move to urban regions is positive in all specifications, but only significant for females coming from the countryside and who did not study in urban regions, i.e. making an active move subsequent graduation. This may reflect the dual career location problem (Costa and Kahn 2000). That the effect is only statistically significant for females is consistent with the widely held belief that females are more likely to follow the career decisions of their husband, sometimes referred to as the 'trailing wife' hypothesis or the problem of 'tied mover' (cf. Cooke 2003, 2008).¹⁸

Turning to the remaining variables, high school grade does not seem to be related to the decision where to start working after graduation. This is in contrast with expectations, but is fully explained by that graduates with better high school grades choose 'better' universities. All regressions include university dummies that capture the effects of grade. High school grade is positive and highly significant when we re-estimate the regressions without the university dummies. Graduates from universities associated with higher high school grades are thus more likely to move to urban regions upon graduation. Furthermore, the male dummy is positive and significant indicating that males are more likely than women to start their career in a large urban region. Finally, age is shown to increase the likelihood of taking the first job in a large urban region although the precision of the estimates is rather poor for most regression specifications.

We conclude that university graduates moving to urban regions subsequent graduation indeed are a select group and the results are broadly in line with expectations. They appear to be more motivated as judged by their high-school grades and entry requirements at the universities they studied at, and they

¹⁷ This is consistent with the widely held belief that women are more likely to adapt to the career of their husband, than the other way around.

¹⁸ This may also explain why being married primarily impact females negatively.

also tend to come from families with stronger education traditions as evidenced by the educational background of their parents.

Wage levels

Table 6 reports estimates of an OLS estimation of the model in (2). The estimated premium for urban regions is highly significant in all regressions ranging from around 6 percent for the overall sample to 12 percent for females leaving the countryside to start working in a large urban region. Women that move from the countryside to take their first job in a large urban region after graduation tend to receive a larger wage effect than men in a similar situation. In contrast, starting a professional career in a city region does not seem to yield any wage advantage as compared to the countryside irrespective of gender. From regressions (1) and (4) we see that the male dummy is positive and significant indicating that men on average earn approximately 4 percent higher initial wages than women regardless of where they start their careers.

Table 6. Initial wage in 2001 of university graduates. OLS regression

	<i>Whole sample</i>			<i>Active movers</i>		
	<i>All</i>	<i>Males</i>	<i>Females</i>	<i>All</i>	<i>Males</i>	<i>Females</i>
	(1)	(2)	(3)	(4)	(5)	(6)
Urban region	0.066*** (0.014)	0.067*** (0.020)	0.061*** (0.020)	0.100*** (0.022)	0.088*** (0.033)	0.119*** (0.035)
City region	0.006 (0.013)	0.007 (0.020)	0.002 (0.020)	0.018 (0.020)	-0.009 (0.031)	0.034 (0.032)
Male	0.037*** (0.008)	—	—	0.034** (0.013)	—	—
Age (ln)	20.6*** (7.92)	25.9*** (9.75)	15.5 (13.0)	26.4* (15.8)	36.3 (22.8)	-3.611 (25.7)
Age sq. (ln)	-3.043** (1.210)	-3.852*** (1.490)	-2.259 (1.986)	-3.932 (2.416)	-5.438 (3.484)	0.647 (3.930)
1 st immigrant	-0.013 (0.024)	-0.013 (0.025)	-0.014 (0.038)	-0.009 (0.030)	-0.012 (0.041)	0.009 (0.056)
2 nd immigrant	-0.005 (0.022)	0.006 (0.028)	-0.025 (0.036)	-0.003 (0.033)	-0.036 (0.050)	0.022 (0.055)
Grade (ln)	0.111*** (0.028)	0.079** (0.036)	0.156*** (0.047)	0.113** (0.053)	0.097 (0.074)	0.074 (0.088)
Educated parent	-0.004 (0.007)	0.007 (0.009)	-0.017 (0.011)	-0.022 (0.015)	-0.012 (0.020)	-0.037 (0.028)
Private	0.052*** (0.016)	0.031 (0.024)	0.077*** (0.024)	0.065** (0.028)	0.053 (0.046)	0.070* (0.038)
Employer size (ln)	0.007*** (0.002)	0.006* (0.003)	0.008** (0.003)	0.002 (0.004)	-0.002 (0.007)	0.006 (0.006)
MNE	0.042*** (0.010)	0.038*** (0.013)	0.044** (0.017)	0.009 (0.019)	-0.011 (0.025)	0.044 (0.031)
R-squared	0.31	0.28	0.30	0.35	0.30	0.38
# observations	4,379	2,476	1,903	1,085	628	457

Note: All regressions include dummy variables for university, field of education, occupation and industry. Robust standard errors in parentheses. *, ** and *** denote statistical significance at the 10-, 5- and 1- percentage level, respectively. Active movers refer to a restricted sample of university graduates that originate from the countryside and did not study at a university in an urban region.

High school grade is important for the initial wage level, especially for women where the estimated effect is almost twice as large as for males. However, the overall effect of high school grade on initial wages is rather small. A 10 percent increase in grades is estimated to result in approximately 1 percent higher initial wages. Put in perspective, comparing the initial wage level for an individual with average high school grades to an identical individual but with top grades, we find that the top grade student earn only about 3 percent higher initial wages than the average student.¹⁹

We find no effect of foreign background on the initial wage levels. Neither the first nor the second generation immigrant dummies reach any satisfactory level of statistical significance in our regressions. In addition, coming from a highly educated home does not seem to matter for graduates' initial wages. However, it is likely that part of the effect of having better educated parents manifest itself through other channels such as high school grades.²⁰ Starting the professional career after graduation at a larger establishment or at a multinational enterprise tends to yield a higher initial income even though the effect is not significant when we restrict our sample to those leaving the countryside to start work in a city region or in a large urban region. Finally, and as anticipated, our result indicates that the private sector pays higher wages than the public sector. The effect is particularly strong for females who gain approximately 7 percent higher initial wages in the private sector as compared to the public sector.

Table 7 provides a robustness test of the OLS estimates in Table 6. It shows the results from fixed effects panel regressions, where the parameters of the location dummy variables are identified based on graduates that move to an urban region in years *after* 2001. The estimator controls for all observed as well as all unobserved time-invariant individual-specific effects and thus enables us to implicitly take into consideration all personal characteristics that do not change over time.

Moving to a large urban region is coupled with an immediate wage level premium of approximately 4 to 5 percent – the premium is somewhat larger for those who grow up in the countryside and for females. In contrast, we find no significant wage premium for those switching to a job in a city region as compared to those starting a new job in the countryside. Again, thick market effects appear to be confined to the larger urban regions. The tenure variable is negative and significant in four regressions while the squared tenure variable fails to reach any satisfactory level of significance. Tenure may be expected to have a positive sign to catch productivity increases due to on the job learning. However,

¹⁹ Moreover, high school grade is probably most important at the beginning of the career when the employer has few alternative ways of judging the ability of the job applicant. Later on in the career, when the worker has gathered a track record of work experience, we can expect other selection criteria to be more important for an employer.

²⁰ The simple correlation coefficient between high school grade and the dummy for highly educated parents is 0.16.

the detected negative effect of tenure on the wage level might, at least partly, be explained by a strong correlation between the tenure variable and the variable capturing job switching making it hard to distinguish the two effects separately. Combined, the result from the two variables suggests that it is on average better to switch jobs often at the beginning of a career instead of remaining with the same employer. This result, hence, provides evidence for the matching hypotheses, which states that a good match between a worker and a job requires the worker to try different jobs to maximize the quality of the match. According to our estimates, this is a good strategy to follow in order to gain a strong wage development.

Table 7. Level-effects on wages – dependent variable: wage level.

	<i>Whole sample</i>			<i>Active movers</i>		
	<i>All</i>	<i>Males</i>	<i>Females</i>	<i>All</i>	<i>Males</i>	<i>Females</i>
	(1)	(2)	(3)	(4)	(5)	(6)
Urban region	0.039*** (0.009)	0.030*** (0.011)	0.052*** (0.016)	0.049*** (0.017)	0.053** (0.021)	0.040 (0.029)
City region	0.013 (0.008)	0.003 (0.011)	0.031** (0.014)	-0.002 (0.013)	0.001 (0.017)	-0.002 (0.022)
Age (ln)	-4.033*** (1.315)	-5.255*** (1.649)	-2.942 (2.132)	-3.146 (2.227)	-3.230 (2.753)	-3.963 (3.663)
Age sq. (ln)	0.918*** (0.194)	1.092*** (0.243)	0.766** (0.315)	0.783** (0.329)	0.785* (0.407)	0.922* (0.542)
Private sector	0.022** (0.011)	0.007 (0.013)	0.036** (0.017)	0.005 (0.019)	0.013 (0.021)	-0.015 (0.034)
Tenure	-0.006*** (0.002)	-0.010*** (0.003)	-0.001 (0.004)	-0.012** (0.004)	-0.011* (0.006)	-0.009 (0.008)
Tenure sq.	-0.000 (0.000)	0.000 (0.000)	-0.001 (0.001)	0.001 (0.001)	0.001* (0.001)	0.000 (0.001)
New employer	0.007* (0.004)	0.007 (0.004)	0.008 (0.006)	0.009 (0.008)	0.010 (0.010)	0.013 (0.012)
Employer size (ln)	0.004*** (0.001)	0.005*** (0.001)	0.003 (0.002)	0.002 (0.002)	0.004 (0.003)	0.004 (0.005)
MNE	0.013** (0.005)	0.009 (0.006)	0.018* (0.010)	0.009 (0.009)	0.005 (0.011)	0.006 (0.017)
R-squared	0.56	0.59	0.54	0.63	0.65	0.60
# observations	29,527	17,144	12,383	7,271	4,308	2,963

Note: All regressions include dummy variables for year, occupation and sector. Robust standard errors in parentheses. *, ** and *** denote statistical significance at the 10-, 5- and 1-percentage level, respectively. Active movers refer to a restricted sample of university graduates that originate from the countryside and did not study at a university in an urban region.

The remaining variables show that switching to a job in the private sector or to a firm belonging to a multinational corporation is coupled with a positive wage increase, all else equal. Our estimates also show that larger establishments tend to pay somewhat higher wages. We also find no significant urban wage premium for female graduates from the countryside.

Wage growth

Table 8 shows the estimated wage growth effects for those who remain in the same type of regional category throughout the entire period. Graduates that move across region types over the nine years on the labor market are the reference group in all specifications. The OLS-estimator does not allow us to

control for unobserved individual-specific effects, but it enables us to estimate the impact observed time-invariant individual-specific effects have on wage growth. Moreover, our data do allow us to control for high-school grades and the education of the parents in the OLS specification, which is pertinent time-invariant information that is typically not observed in the many datasets.

Table 8. Wage growth of university graduates by location. OLS regression.

	<i>Whole sample</i>			<i>Active movers</i>		
	<i>All</i>	<i>Males</i>	<i>Females</i>	<i>All</i>	<i>Males</i>	<i>Females</i>
	(1)	(2)	(3)	(4)	(5)	(6)
Urban region	0.021*** (0.002)	0.021*** (0.004)	0.023*** (0.005)	0.034*** (0.005)	0.031*** (0.007)	0.042*** (0.009)
City region	-0.022*** (0.003)	-0.023*** (0.004)	-0.022*** (0.006)	-0.008 (0.006)	-0.006 (0.007)	-0.016 (0.009)
Countryside	-0.009** (0.005)	-0.006 (0.006)	-0.009 (0.008)	-0.012* (0.006)	-0.004 (0.008)	-0.023* (0.013)
Male	0.019*** (0.002)	–	–	0.024*** (0.005)	–	–
Age (ln)	-0.032 (0.973)	-1.398 (1.199)	2.716 (1.671)	0.326 (1.646)	-0.828 (2.130)	2.707 (2.796)
Age sq. (ln)	0.027 (0.143)	0.230 (0.176)	-0.379 (0.247)	-0.023 (0.243)	0.143 (0.314)	-0.364 (0.414)
Grade (ln)	0.071*** (0.008)	0.054*** (0.010)	0.108*** (0.016)	0.075*** (0.017)	0.045** (0.020)	0.166*** (0.033)
Educated parent	0.001 (0.002)	0.002 (0.003)	-0.002 (0.004)	-0.001 (0.004)	0.002 (0.005)	-0.006 (0.008)
1 st immigrant	-0.009 (0.006)	-0.011 (0.008)	-0.007 (0.009)	-0.007 (0.011)	0.020 (0.018)	-0.049*** (0.016)
2 nd immigrant	-0.011* (0.006)	-0.007 (0.006)	-0.016 (0.012)	0.005 (0.012)	0.038** (0.016)	-0.050*** (0.018)
Tenure	-0.004** (0.002)	-0.006** (0.002)	-0.001 (0.003)	-0.003 (0.003)	-0.003 (0.004)	-0.003 (0.006)
Tenure sq.	0.000 (0.000)	0.001* (0.000)	-0.001 (0.000)	0.001 (0.001)	0.001 (0.001)	0.001 (0.001)
New employer	0.021*** (0.004)	0.025*** (0.005)	0.018*** (0.006)	0.026*** (0.007)	0.027*** (0.009)	0.026** (0.012)
Private sector	0.031*** (0.005)	0.015** (0.006)	0.045*** (0.008)	0.040*** (0.009)	0.041*** (0.011)	0.051*** (0.016)
Employer size (ln)	0.006*** (0.001)	0.004*** (0.001)	0.007*** (0.001)	0.0041*** (0.001)	0.005** (0.001)	0.003* (0.002)
MNE	0.006** (0.003)	0.004 (0.003)	0.012** (0.005)	0.003 (0.005)	-0.004 (0.006)	0.011 (0.009)
Initial wage (ln)	-0.393*** (0.012)	-0.387*** (0.016)	-0.413*** (0.019)	-0.358*** (0.023)	-0.349*** (0.029)	-0.411*** (0.038)
R-squared	0.25	0.25	0.25	0.23	0.24	0.26
# observations	23,682	13,925	9,157	5,826	3,517	2,309

Note: All regressions include dummy variables for university, field of education, occupation and industry. Robust standard errors in parenthesis. *, ** and *** denote statistical significance at the 10-, 5- and 1- percentage level, respectively. Active movers refer to a restricted sample of university graduates that originate from the countryside and did not study at a university in an urban region.

The results point towards a strong wage growth effect for those working in a large urban region. University graduates working in a large urban region throughout the whole period earn on average between 2 and 3 percentage points higher annual wage growth than those working in the countryside. The effect is highly significant for all regression specifications and is most pronounced for females

moving from the countryside to start their career in a large urban region. Working in a city region does not yield any significant wage growth effect as compared to working in the countryside.²¹

High school grade has a significant positive effect on wage growth even after controlling for university effects. This is consistent with the findings of Miller (1998), who uses a sample of workers in the US and show that high school grades are able to predict their long-term earnings.²² Our estimates suggest that the effect is about twice as important for females where the annual wage is estimated to grow by around 4 percentage points faster for a student with top grades as compared to the average female student. It is also clearly visible from the estimates in the table that working in the private sector is consistent with a much steeper wage development as wages for workers in the private sector grow by between 2 to 5 percentage points faster per year than in the public sector depending on regression specification. Another conclusion to be drawn from the table is that switching jobs provides an additional boost to wage growth by approximately 2 percentage points. The effect is particularly strong for university graduates from the countryside.

The estimates also reveal that working in larger establishments have a positive impact on the annual wage growth. However, the effect is not that big – doubling the number of workers in an establishment increases wage growth by half a percentage point. Furthermore, no clear wage growth effects can be found for workers with a foreign background or for workers with highly educated parents. Finally, neither the tenure variables nor the multinational corporation dummy seem to be particularly important for explaining wage growth.

In summary, the results reported in Tables 5–8 provide strong support for the hypotheses that larger urban regions provide advantages of thick markets for skills. Working in a dense environment with a thick labor market with many employers to choose from facilitates for workers to search for a good match between their skills and aptitudes and the requirements demanded by the job. The search process involves frequent job switching in the beginning of the professional career which of course provides a disadvantage for less dense regions that lack the range of employers found in more densely populated regions. The evidence provided by the regressions also highlights the general role job switching has for wages. Changing employer, regardless of region, yields a positive wage level effect as well as a positive wage growth effect which can be interpreted as a result of a continuous job match

²¹ We have also estimated a fixed effects panel model with annual wage growth as the dependent variable. While this model does not allow us to identify the effect of remaining in the same region over all nine years, we find that switching to a job in a large urban region result in a strong positive wage effect. Our estimates suggest that the growth rate of wages increase by approximately four percentage points the year a graduate move to a big city during periods after 2001. As before, however, no significant wage effect is found for city regions. These results are available from the authors upon request.

²² Miller (1998) makes use of the so-called ‘sophomore cohort’ of the *High School and Beyond* data set (HSB) in the US.

improvement. We also show that these results hold in general for³ both male and female graduates, as well as for workers moving to urban regions upon graduation from the university with no prior coupling to such regions.

5. CONCLUSIONS

The vast majority of graduates move to large cities to begin their professional labor market careers. We set out to understand this spatial concentration of university graduates. This is an issue of importance, not least since the spatial distribution of highly educated workers is considered a key determinant of divergence in growth, incomes and well-being between regions (Moretti 2012).

Our main finding is that the attraction of urban regions among university graduates is to be found in their labor market characteristic; i.e. they provide thicker markets for skills. This is manifested by higher initial wages, faster wage growth and more frequent job switching during the early labor market career of university graduates moving to urban regions upon graduation.

Urban regions are ‘net receivers’ of human capital in Sweden, while all other areas act as ‘net senders’ of university graduates. The graduates who start to work in large urban regions are not a random sample of graduates, but rather a select group of individuals. In general, coming from a family background with highly educated parents makes it more likely to start the first job in a large urban region after graduation. University graduates with better high school grades, and also from universities associated with higher entry requirements in terms of such grades, are also more likely to move to urban regions subsequent graduation. We also show that it is especially unmarried females with better high school grades and educated parents that are particularly prone to leave the countryside to start working in large urban regions after graduation. These selection results point to that it is in particular more able and motivated graduates that make an active move to urban regions, i.e. graduates for which labor market characteristic and career prospects are likely to be more important.

We also find robust evidence that there is a positive wage premium of entering the thicker labor markets in urban regions. University graduates that start their professional career in large urban regions earn around 7 percent higher initial wages as compared to working in other types regions. Panel regressions with fixed individual-specific effects reveal that moving to an urban region during the first years on the labor market tend to give an immediate nominal wage increase by approximately 4 percent. These results are consistent with models emphasizing that expected match qualities rise with market thickness. However, we also show that university graduates choosing to begin their professional labor market career in urban regions also experience higher wage growth. In fact, those university graduates entering the labor market in an urban region directly after graduation and remain

there during the eight first years on the labor market show the highest average yearly wage growth. One reason for this is that these university graduates enjoy benefits of ‘agglomeration economies’, i.e. interactions between workers and their local environment that lead to productivity gains. An important source of such agglomeration economies is matching, where workers benefit from the thicker labor markets in urban regions. We indeed find higher rates of job switching among university graduates operating in urban regions, consistent with the idea that graduates in denser regions are in a better position to ‘shop around’ in the early job market career to find a good match on the labor market. These results are perfectly in line with Wheeler’s (2006) findings for young workers in the US: “an important aspect of ‘learning’ in cities may involve individuals learning about what they do well” (ibid, p.162).

A further finding is that the described effects of market thickness for skills seem to be confined to big urban cities. We distinguished between three types of regions – urban, city and countryside regions – but we found no statistically significant difference between city and countryside regions in terms of neither wage levels nor wage growth. This suggests that a ‘critical mass’ in terms of population density is needed to reap the advantages of market thickness.

During the last decades there has been a debate in the literature as regards the relative roles of jobs on the one hand and amenities in the other in attracting human capital (see e.g. Storper and Scott 2009, Niedomysl and Hansen 2010, Scott 2010). Our results for the case of university graduates lend strong support for that labor market characteristics, and in particular early labor market career prospect, are key attractors. Policies aiming at attracting or retaining young university graduates should thus target labor market aspects of regions.

REFERENCES

- Andersson, M and P. Thulin (2013), “Does Spatial Employment Density Spur Inter-Firm Job Switching?”, *Annals of Regional Science*, forthcoming, DOI 10.1007/s00168-012-0544-y
- Andersson, M, and H. Löf (2012), “Small Business Innovation – firm-level evidence from Sweden”, *Journal of Technology Transfer*, 37(5), 732-754
- Andersson, M, J. Klaesson and J.P Larsson (2013), “The Sources of the Urban Wage Premium by Worker Skills – spatial sorting or agglomeration economies?”, *Papers in Regional Science*, forthcoming
- Bacolod, M, B.S. Blum and W. Strange (2009), “Skills in the city”, *Journal of Urban Economics*, 65, 136-153

- Badinger, H. and G. Tondl (2003), "Trade, Human Capital and Innovation: the engines of European regional growth in the 1990s", in B.Fingleton (ed.), *European regional growth*, Series: Advances in Spatial Science, Heidelberg, Springer, 215-240.
- Bel, G and X. Fageda (2008), "Getting there Fast: globalization, intercontinental flights and the location of headquarters", *Journal of Economic Geography*, 8, 471-495
- Bradley, S. and J. Taylor (1996), "Human Capital Formation and Local Economic Performance", *Regional Studies*, 30, 1-14.
- Cheshire, P.C. and S. Magrini (2000), "Endogenous Processes in European Regional Growth: implications for convergence and policy", *Growth and Change*, 32, 455-79
- Clark, A.E (2001), "What Really Matters in a Job? - hedonic measurement using quit data", *Labour Economics*, 8, 223-42
- Combes P, G Duranton and L Gobillon (2008), "Spatial wage disparities: sorting matters!", *Journal of Urban Economics* 63: 723-742
- Cooke, T.J (2003), "Family Migration and the Relative Earnings of Husband and Wives", *Annals of the Association of American Geographers*, 93(2), 338-249
- Cooke, T.J (2008), "Migration in a Family Way", *Population, Space and Place*, 14(4), 255-265
- Costa, D and M. Kahn (2000), "Power Couples: changes in the locational choice of the college educated 1940-1990", *Quarterly Journal of Economics*, 115, 1287-1315
- Duranton, G. and D. Puga (2004), "Micro-foundations of Urban Agglomeration Economies," in J. V. Henderson and J. F. Thisse (eds), *Handbook of Regional and Urban Economics*, chapter 48, 2063-2117
- Dustmann, C (2004), "Parental Background, Secondary School Track Choice and Wages", *Oxford Economic Papers*, 56, 209-230
- Faggian, A and P. McCann (2006), "Human Capital Flows and Regional Knowledge Assets: a simultaneous equation approach", *Oxford Economic Papers*, 58, 475-500
- Faggian, A and P McCann (2009a), "Human Capital, Graduate Migration and Innovation in British Regions", *Cambridge Journal of Economics*, 33, 317-333
- Faggian, A and P. McCann (2009b), "Universities, Agglomerations and Graduate Human Capital Mobility", *Tijdschrift voor Economische en Sociale Geografie*, 100, 210-223
- Farber, H.S. (1994), "The Analysis of Inter-Firm Worker Mobility," *Journal of Labor Economics*, 12(4), 554-593
- Finney, M.M. and J. Kohlhase (2008), "The Effect of Urbanization on Labor Turnover," *Journal of Regional Science*, 48(2), 311-328.
- Freeman, R.B (1978), "Job Satisfaction as an Economic Variable", *American Economic Review*, 68, 135-141

- Geiser, S and M.V Santelices (2007), “Validity of High School Grades in Predicting Student Success Beyond the Freshman Year”, Research and Occasional Paper Series CSHE 6.07, University of California, Berkley
- Glaeser, E and D Maré (2001), “Cities and skills”, *Journal of Labor Economics* 19: 316-342
- Glaeser, E and P.D Gottlieb (2006), “Urban Resurgence and the Consumer City”, *Urban Studies*, 43(8), 1275-1299
- Glaeser, E., J. Scheinkman and A. Schleifer (1995), “Economic Growth in a Cross-section of Cities”, *Journal of Monetary Economics*, 36, 117-143
- Granovetter, M.S. (1995), *Getting a Job: a study of contacts and careers*, 2nd ed. University of Chicago Press, Chicago.
- Grogger, J and E. Eide (1995), “Changes in College Skills and the Rise in the College Wage Premium”, *Journal of Human Resources*, 30(2), 280-310
- Grund, C and D. Sliwka (2007), “Reference-Dependent Preferences and the Impact of Wage Increases on Job Satisfaction: Theory and Evidence”, *Journal of Institutional and Theoretical Economics*, 16, 313-335
- Hesley, R. and W. Strange (1990), “Matching and Agglomeration Economies in a System of Cities”, *Regional Science and Urban Economics*, 20(2), 189–212
- Jacobs, W., H. Koster and F. van Oort (2013), “Co-agglomeration of Knowledge-Intensive Business Services and Multinational Enterprises”, *Journal of Economic Geography*, forthcoming doi:10.1093/jeg/lbs055
- Kim, S (1990), “Labor Heterogeneity, Wage Bargaining and Agglomeration Economies”, *Journal of Urban Economics*, 28(2), 160–177
- Lehmer, F and J. Möller (2010), "Interrelations between the Urban Wage Premium and Firm-Size Wage Differentials: a microdata cohort analysis for Germany", *Annals of Regional Science*, 45, 31-53
- Li, G and Q. Li (2005), “Efficiency of Thin and Thick Markets”, NBER Working paper 10815
- Matano, A and P. Naticchioni (2012), "Wage Distribution and the Spatial Sorting of Workers", *Journal of Economic Geography*, 12, 379-408
- Miller, S.R (1998), “Shortcut: high school grades as a signal of human capital”, *Educational Evaluation Policy Analysis*, 20(4), 299-311
- Moretti, E (2012), *The New Geography of Jobs*, Harcourt Publishing Company, New York
- Moretti, E and P. Thulin (2013), “Local Multipliers and Human Capital in the United States and Sweden”, *Industrial and Corporate Change*, 22(1), 339-362
- Niedomysl, T and H. Hansen (2010), “What Matters More for the Decision to Migrate? – jobs versus amenities”, *Environment and Planning A*, 42(7), 1636-1649
- Scott, A. J (2010), “Jobs or Amenities? - destination choices of migrant engineers in the USA”, *Papers in Regional Science*, 89(1), 43-63

- Shapiro, J (2005), “Smart Cities: Quality of Life, Productivity, and the Growth Effects of Human Capital”, NBER Working Papers 11615
- Simon, C (1998), “Human Capital and Metropolitan Employment Growth”, *Journal of Urban Economics*, 43, 223-243
- Storper, M. and Scott, A. J. (2009) “Rethinking Human Capital, Creativity and Urban Growth”, *Journal of Economic Geography*, 9(2), 147-167
- Topel, R.H. and M.P. Ward (1992), “Job Mobility and the Careers of Young Men,” *Quarterly Journal of Economics*, 107(2), 439–479
- Venhorst, V.A, J. van Dijk and L. van Wissen (2011), “An Analysis of Trends in Spatial Mobility of Dutch Graduates”, *Spatial Economic Analysis*, 6(1), 57-82
- 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.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

APPENDIX

Data

Several adjustments of the original data have been made to ensure that the dataset is well-selected; we only include those individuals that have employment for all years 2001–2009 (i.e. we exclude entrepreneurs and sailors), we further exclude those individuals where the share of unemployment benefits compared to the wage exceeds 25 percent (since these could otherwise bias our sample) or that have any income from entrepreneurial activities during any of the years. The latter restriction is due to that we aim to isolate effects of location on labor income. Business owners may for instance substitute labor income for capital gains for tax reasons (taxes on capital gains are much lower than the taxes on labor incomes, especially in the higher labor income brackets), and we lack information on capital gains. Furthermore, the graduates are restricted to those with a degree in engineering, the natural or the social sciences. We remove all observations where the individual has children which make the sample unbalanced as we keep individuals until this occurs. Children often means parental leave on either full- or part-time and parental leave may or may not be shared between males and females in a household. As the data do not fully inform about parental leave we choose to leave out graduates when having children, as it may otherwise distort our estimates of labor income.

Table A1. Descriptive statistics for graduates after eight years in the labor market (2009).

<i>Variable</i>	All: 2009		Men: 2009		Women: 2009	
	<i>Mean</i>	<i>Std. Dev.</i>	<i>Mean</i>	<i>Std. Dev.</i>	<i>Mean</i>	<i>Std. Dev.</i>
Wage (in 100 EUR)	570.44	229.74	593.83	248.64	530.44	186.07
Age	34.26	1.50	34.34	1.48	34.12	1.53
Urban regions	0.68	0.47	0.69	0.46	0.67	0.47
City regions	0.23	0.42	0.23	0.42	0.23	0.42
Countryside regions	0.09	0.29	0.09	0.28	0.10	0.30
Social sciences	0.39	0.49	0.26	0.44	0.61	0.49
Natural sciences	0.10	0.30	0.09	0.28	0.11	0.32
Engineering	0.51	0.50	0.65	0.48	0.27	0.45
Married	0.19	0.39	0.18	0.39	0.20	0.40
Average high school grade	3.73	0.81	3.69	0.71	3.81	0.85
Parent with higher education	0.39	0.49	0.40	0.49	0.39	0.49
Father with higher education	0.27	0.44	0.28	0.45	0.26	0.44
Mother with higher education	0.26	0.44	0.26	0.44	0.28	0.45
Partner with higher education	0.10	0.30	0.11	0.31	0.09	0.29
First-generation immigrant	0.03	0.18	0.02	0.15	0.06	0.23
Second-generation immigrant	0.03	0.18	0.04	0.18	0.03	0.17
Works in multinational enterprise	0.61	0.49	0.66	0.18	0.53	0.50
Private sector	0.78	0.42	0.84	0.36	0.67	0.47
Manufacturing sector	0.26	0.44	0.28	0.45	0.22	0.42
Service sector	0.57	0.50	0.61	0.49	0.51	0.50
Public sector	0.16	0.37	0.11	0.31	0.26	0.44
Establishment size	787	1,837	862	1,955	656	1,606
Men	0.63	0.48	–	–	–	–
Tenure	3.64	2.97	3.69	2.95	3.54	2.99
Number of jobs	1.70	1.39	1.64	1.35	1.81	1.46
# of observations	1,699		1,078		621	

Note: The table reports basic descriptive statistics for Swedish university graduates in 2009 that graduated in 2000 and have nine years of labor market experience. Tenure is defined as the average number of years the graduates have remained with the same employer. Number of jobs is the number of different employers between 2001 and 2009. An asterisk implies that the number of observations is somewhat smaller than for the other variables. The exchange used is the average exchange rate from February 8th 2012 to February 8th 2013 (1 EUR=8.6792 SEK).

Table A2. Variable definitions.

Variable	Definition
Wage	The total wage earnings of a worker during a year . The exchange used is the average exchange rate from February 8 th 2012 to February 8 th 2013 (1 EUR=8.6792 SEK). The variable used in regressions is in logarithms
Age	In full years, as of January 1 st
Urban regions	A dummy for whether the graduate works in a region classified as urban
City regions	A dummy for whether the graduate works in a region classified as a city region
Countryside regions	A dummy for whether the graduate works in a region classified as countryside
Social sciences	A dummy which is 1 if the graduate has a degree in the social sciences
Natural sciences	A dummy which is 1 if the graduate has a degree in the natural sciences
Engineering	A dummy which is 1 if the graduate has a degree in engineering
Married	A dummy which is 1 if the graduate is married
Average high school grade	A continuous variable between 1-5, where 1 is the lowest and 5 is the highest. This serves as a proxy for ability.
Parent with higher education	A dummy which takes the value 1 if either of the parents have a university education 3 years or longer
Father with higher education	A dummy which takes the value 1 if the father has a university education 3 years or longer
Mother with higher education	A dummy which takes the value 1 if the mother has a university education 3 years or longer
Partner with higher education	A dummy which takes the value 1 if the partner/spouse has a university education 3 years or longer
First-generation immigrant	A dummy which takes the value 1 if the graduate has immigrated to Sweden
Second-generation immigrant	A dummy which takes the value 1 if the graduate's parents have immigrated to Sweden
Works in multinational enterprise	A dummy which takes the value 1 if the graduate works in a multinational enterprise
Private sector	A dummy which takes the value 1 if the graduate works in the private sector
Manufacturing sector	A dummy which takes the value 1 if the graduate works in the manufacturing sector
Service sector	A dummy which takes the value 1 if the graduate works in the service sector
Establishment size	The size of the establishment the graduate is employed at in November. In logarithms.
Tenure	The number of years the graduate has been employed at the current workplace. Maximum tenure is the observational year minus 2001.
Number of prior employers	The number of different employers the worker has had since 2001.
Job change	A dummy which takes the value 1 if the worker changed occupation between year t and t-1.
Sector affiliation	Dummies for different sectors at the level of 2-digit NACE sectors.
Occupational codes	From ILO on the 1-digit level.

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