Economics Working Paper

2010-14

Residential Location, Job Location, and Wages: Theory and Empirics

Rune M. Vejlin

School of Economics and Management
Aarhus University
Bartholins Allé 10, Building 1322
DK-8000 Aarhus C - Denmark
Phone +45 8942 1610
Mail: oekonomi@econ.au.dk
Web: www.econ.au.dk

Residential Location, Job Location, and Wages: Theory and Empirics

Rune Vejlin*

Aarhus University and LMDG

August 17, 2010

Abstract

I develop a stylized partial on-the-job equilibrium search model which incorporate a spatial dimension. Workers reside on a circle and can move at a cost. Each point on the circle has a wage distribution. Implications about wages and job mobility are drawn from the model and tested on Danish matched employer-employee data. The model predictions hold true. I find that workers working farther away from their residence earn higher wages. When a worker is making a job-to-job transition where he changes workplace location he experiences a higher wage change than a worker making a job-to-job transition without changing workplace location. However, workers making a job-to-job transition which makes the workplace location closer to the residence experiences a wage drop. Furthermore, low wage workers and workers with high transportation costs are more likely to make job-to-job transitions, but also residential moves.

JEL Classification: J6,J3,R3

Keywords: ob mobility, residential mobility, wage dynamics, search

*Corresponding author at: School of Economics and Management, Aarhus University, DK-8000 Aarhus C, Denmark. email: rvejlin@econ.au.dk. I would like to thank Maria Humlum and Michael Svarer for helpful comments and the LMDG project for providing me with the data. I greatly acknowledge financial support from the Danish Social Sciences Research Council (grant no. FSE 09-066745).

1 Introduction

Worker's individual location choice of residence and job are closely interdependent. However, most studies of job mobility and wages do not take into account the location of the worker's residence relative to the location of the job. Almost all literature using structural search models ignore the joint decision of workplace and residential location taken by the worker. This paper provides a theoretical on-the-job search model incorporating a spatial dimension, hereby allowing the worker to consider locational choices. The model implications are tested on a Danish employer-employee data set and hold true for almost all specifications.

There exists a small but increasing literature on search models with spatial features. Brueckner and Zenou (2003) use a minimum wage framework and an efficiency wage framework in order to explain the spatial mismatch hypothesis, i.e., the fact that black workers reside in segregated zones which are distant and poorly connected to major centers of growth. In their model black workers use less land to live on, and therefore have steeper bid-rent curves which initially locates them near the Central Business District (CBD) of the linear city. If a Suburban Business District emerges at the other end of the linear city, then black workers would move there, but if they are discriminated against and therefore cannot, then they will continue to live near the city center and experience higher unemployment. The higher unemployment is caused by black workers having a harder time finding employment because of the increased distance to jobs.

Smith and Zenou (2003), Zenou (2009) and Zenou (2010) use a monocentric circular model in order to describe a joint equilibrium of employed and unemployed workers and residential location. All three papers build on the idea of a CBD in which all employed workers are working. However, none of the papers include on-the-job search and are therefore incapable of relating job-to-job transitions and wages. Nagypal (2005) demonstrates that job-to-job transitions are very common and it is therefore important to understand how they interact with residential decisions. This paper contributes in this direction. Van Ommeren et al. (2000) derive an on-the-job search model where workers search both for a job and a residential location. Jobs have two characteristics; a wage and a commuting distance, while residences also consist of two characteristics; a place utility and a commuting distance. However, there is no notion of space directly in the model, so jobs are not tied to a specific location, i.e., the notion of cities with better job offer distributions cannot be analyzed in this framework.

Numerous empirical studies have shown that commuting time is positively related to job and residential mobility, see Van Ommeren (2000), Clark, Huang, and Withers (2003), Manning (2003), and Clark and Huang (2004). Madden and Chiu (1990) investigate whether or not differences in commuting times between men and women can explain the gender wage gap. They find little evidence of this among both white and black, two wage-earner households. Timothy and Wheaton (2001) find that there is up to 15-20 percent differences in wages between suburban locations and the city center within the same metropolitan area (Boston and Minneapolis) controlling for a wide range of individual characteristics. But there are also large variations between different suburban areas. Madden and Chiu also find a positive relationship between average wages in an area and the average commuting time for workers working within that area. Hourly compensation for commuting times is 1.6 to 3 times the wage rate, which could be consistent with a worker valuing commuting time and work time the same and having commuting costs as high or a little higher than hourly wages.

Most studies of individual wage dynamics find that about 30-50 percent of job-to-job transitions are followed by a wage decrease, see e.g. Postel-Vinay and Robin (2002). Standard search models cannot explain this observation. Several explanations have been proposed to solve the apparent paradox. One way to deal with negative wage jumps has been to allow for the possibility of measurement error in wages. However, this is not satisfying in the sense that the measurement error has to be unreasonably large in order to generate the observed pattern in the data. Dey and Flinn (2005) incorporate health insurance into a search and matching framework thereby allowing firms to have two attributes, the wage and the provision of health insurance. A worker who demands health insurance is willing to take a wage cut in order to move to a firm which offers health insurance. Postel-Vinay and Robin (2002) introduce an alternating offer game between employers over the workers, i.e., the incumbent firm are allowed to make counter offers when an employed worker meets a new firm. One of the central implications of this model is that workers are willing to take wage cuts when moving between firms, since being at a high productivity firm increases later wage gains from the alternating offers game. Finally, Taber and Vejlin (2010) encompass compensating differentials into a search model and show that non-pecuniary firm attributes are important and can generate job-to-job transitions with a wage cut. This paper suggests a new explanation of why job-to-job transitions so often are followed by a wage decrease. The hypothesis is that workers moving to a job closer to their residential location potentially are willing to take a wage cut. They are willing to do this in order to save the cost of transportation between the workplace and the residence. This can be seen as a compensating differential due to transportation costs, but it is not modelled explicitly in Taber and Vejlin (2010).

This paper develops a simple partial equilibrium search model where workers live on a circle and residential moves are costly. Each point on the circle has a wage distribution. Jobs get exogenously destroyed, and workers get job offers both when employed and unemployed. Thus, the workers spend their lives cycling between employment and unemployment. Residential moves are endogenized. The model holds particular predictions about the link between wages, residential choice, workplace choice, and mobility. These are tested on a matched Danish employer-employee data set. None of the empirical studies of locational choices mentioned above explicitly study wage changes in the analysis. Thus, one of the main contributions of this paper is to investigate the level of accepted wages for workers following a job-to-job transition. An interesting pattern emerges which is consistent with the model. Workers making a job-to-job transition in a given year have higher wage increases than workers who stay at their current job. This is a standard finding and it is in accordance with basic search models. However, following a job-to-job transition, workers who change work location to a different county have higher wage increases than workers making a job-to-job transition within the same county. Perhaps even more interesting, workers moving to a workplace closer to their residence on average experience a wage drop. This provides a credible new explanation of the frequently observed wage drops following job-to-job transitions. I also find that job-to-job transitions associated with the highest wage increases are those where both work location and residential location are changed. Finally, I find that low wage workers and workers who have a large distance between workplace and residence are more likely to make a job-to-job transition. This also holds for a joint job-to-job transition and a residential move. All the empirical findings in the paper support the model and suggests that locational considerations are important for workers when deciding about taking a job offer.

The structure of the paper is as follows. In section 2 the model is presented and analyzed. The data used is presented in section 3. In section 4 I present the results and finally, in section 5 I conclude.

2 Model

In this section I develop a stylized, partial on-the-job equilibrium search model in which workers live on a circle and where each point on the circle has a wage distribution. Workers get fired at an exogenous rate and can find new jobs both when employed and unemployed. So far, circular models have primarily been used in the search literature when investigating sorting between workers and firms, see e.g. Marimon and Zilibotti (1999) and Gautier, van Vuuren and Teulings (2010).

2.1 Circular model

Workers are living on a circle with circumference 1, but they can move at a cost, c. Jobs are exogenously located on the circle and are characterized by a wage, w, and a location, l. The joint offer distribution of wages and locations is given by $F(w,l)$ with $\underline{w(l)}$ and $\overline{w(l)}$ being the lowest and the highest wages at location l, respectively. The value of being employed in a job at location l, at a wage w, and living at location h is given by the asset value equation

$$\begin{aligned} rW(w,h,l) &= w - t(d(l,h)) - \delta(W(w,h,l) - U(h)) \\ &\quad + \lambda \int_0^1 \int_{\underline{w(l)}}^{\overline{w(l)}} \max \left\{ \begin{array}{c} 0, W(x,h,y) - W(w,h,l), \\ W(x,y,y) - c - W(w,h,l) \end{array} \right\} dF(x,y) \end{aligned}$$

where $t(\cdot)$ is the transportation cost which is increasing and convex, $d(l,h)$ is the distance between h and l, defined as

$$d(l,h) = \min_{x \in \mathbb{Z}} |h - l + x|$$

So $d(l,h)$ is in the range of [0,1/2]. δ is the job destruction rate, and λ is the arrival rate of job offers. The worker basically has three options when a job offer arrives. First, he can reject the offer. Second, he can accept the offer and choose not to move. And third, he can accept the offer and chose to move. In order to make the model as simple as possible, I only allow the worker to move to the location of the new job. For some distributions of F the worker might want to move to a different location than that of the new job, e.g. if it is highly likely that he will later find a job there later. This is assumed not to be an option for the worker, and corresponds to assuming that the distribution of wages are not too different between locations sufficiently close to one another.

The value of being unemployed is given by the asset value equation

$$rU(h) = b + \lambda \int_0^1 \int_{\underline{w(l)}}^{\overline{w(l)}} \max(0, W(x,h,y) - U(h), W(x,y,y) - c - U(h)) dF(x,y)$$

I assume that the unemployed worker has no transportation cost, so being unemployed is the same as being employed at location h at a wage b. Since the job offer arrival rate is independent of the location of the worker, the unemployed worker will never move.

2.2 Analysis

The question is in what regions of the joint distribution of w, h, and l the worker wants to take which actions. The worker basically has three options when getting a job offer, 1) he can reject the offer and stay in his current state, 2) he can accept the offer and not move residential location, or 3) he can accept the offer and move to the new location at a cost c. In order to analyze when he wants to take which action, I break the decision down into three sub-scenarios where he only has two choices.

Let us first have a closer look at when the employed worker is indifferent between rejecting a job offer and accepting the job, but not moving residential location. One can show that the reservation wage $\widetilde{w}_1$ at location $\widetilde{l}_1$ is given by[1]

$$\widetilde{w}_1 = w + t(d(\widetilde{l}_1, h)) - t(d(l,h)) \tag{1}$$

This equality implicitly defines the set $(\widetilde{w}_1, \widetilde{l}_1)$ for which the worker is indifferent. If there are no difference between the search technologies while employed and unemployed, the worker only has to be compensated for his higher or lower transport costs. If the new job is closer to home than the current job, the worker is willing to accept a wage decrease in order to save transportation costs.

We now turn to the set of $(\widetilde{w}_2, \widetilde{l}_2)$ for which the worker is indifferent between accepting the job

[1] See Appendix

offer and staying and accepting the job offer and moving to location $\widetilde{l}$. One can show that[2]

$$
\begin{aligned}
& t(d(\widetilde{l}_2, h)) = (r+\delta)c \qquad (2) \\
& -\lambda\{\int_0^1 \int_{\underline{w(l)}}^{\overline{w(l)}} \max\left\{0, W(x,h,y) - W(\widetilde{w}_2, h, \widetilde{l}_2), W(x,y,y) - c - W(\widetilde{w}_2, h, \widetilde{l}_2)\right\} \\
& - \max\left\{0, W(x, \widetilde{l}_2, y) - W(\widetilde{w}_2, \widetilde{l}_2, \widetilde{l}_2), W(x,y,y) - c - W(\widetilde{w}_2, \widetilde{l}_2, \widetilde{l}_2)\right\} dF(x,y)\}
\end{aligned}
$$

It is easy to see that the term under the integral is greater than zero since $W(\widetilde{w}_2, \widetilde{l}_2, \widetilde{l}_2) > W(\widetilde{w}_2, h, \widetilde{l}_2)$. From equation 2 one can see that the higher the cost of moving, the higher the transportation cost, $t(d(\widetilde{l}_2, h))$, can be before the worker wants to move. Also, the higher the job destruction rate, the higher is the transportation cost the worker is willing to endure since the expected duration of the job is smaller. Likewise the higher the job finding rate is, the less likely the worker is to move, since he will find a job closer to his current home at a higher rate.

Finally, we need to find out for which set of $(\widetilde{w}_3, \widetilde{l}_3)$ the worker is indifferent between rejecting the job offer and accepting the job offer and moving. One can show that the worker is indifferent when[3]

$$
\begin{aligned}
& \widetilde{w}_3 - w = (r+\delta)c - t(d(l,h)) \qquad (3) \\
& +\lambda\{\int_0^1 \int_{\underline{w(l)}}^{\overline{w(l)}} \max(0, W(x,h,y) - W(w,h,l), W(x,y,y) - c - W(w,h,l)) - \\
& \max(0, W(x, \widetilde{l}_3, y) - W(w,h,l) - c, W(x,y,y) - 2c - W(w,h,l)) dF(x,y)\} \qquad (4)
\end{aligned}
$$

Notice that the term inside the integral is larger than zero. The wage difference has to compensate the worker for the cost of moving minus the saved transportation cost. The higher the job offer arrival rate, the higher the wage difference between the current and the new job has to be, since a higher job offer arrival rate implies a higher probability of finding a better job closer to the current home. The lower the wage in the current job, the higher is the probability of moving residential location.

Let us look at a special case, where $G(w|l) = F(W \leq w, L = l)$, i.e., the wage distribution conditional on location, is equal for all l. In this case the location of the new job, $\widetilde{l}_3$, does not affect

[2] See Appendix
[3] See Appendix

the decision between rejecting the job offer and accepting the job offer and moving. This is the case since the option value of getting a new job does not depend on the location of the current job. Likewise, for the decision between accepting the job offer at a wage $\widetilde{w}_3$ at location $\widetilde{l}_3$ and accepting the job offer and moving to location, $\widetilde{l}_3$ does not depend on $\widetilde{w}_3$. For this special case one can draw this graphical illustration of the decisions of the worker from equation 1, 2, and 3. This is done in figure 1[4].

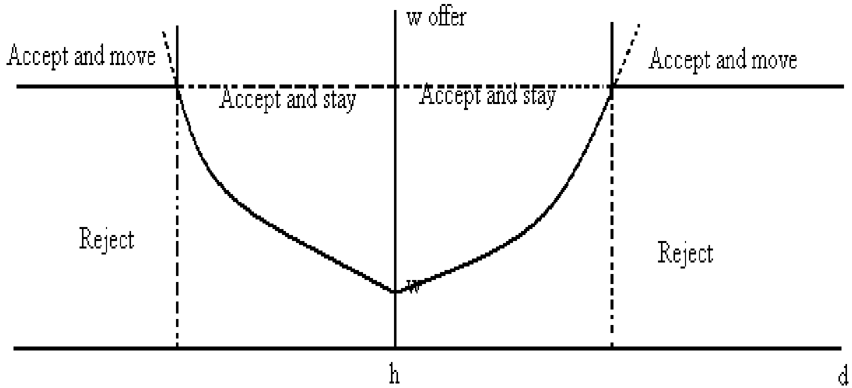

Figure 1: Graphical illustration of worker's choice

The lines are drawn from the equations. The dotted part is the part not used because it is dominated by a different strategy. The horizontal line is the indifference curve between reject the job offer and accepting the job offer and moving residential location. The vertical line is the indifference curve between accepting the job offer and moving residential location and accepting the job offer and not changing residential location. Finally, the parabola is the indifference curve between rejecting and accepting the job offer and not changing residential location.

2.3 Model predictions

From equation 1 we can see that for those workers who change job but do not move the reservation wage is only higher than the current wage if the new job is further away from home than the old job. The increase in reservation wage takes place because a worker who does not change residential location only receives compensation for the added transportation costs, i.e., the further away the place of work is from the residence, the higher the realize wage increase should be for job-to-job

[4]The proof of why the lines intersect is in the Appendix and are derived using reveal preferences.

transitions. If the job is closer to home, the reservation wage is lower than the current wage, and the worker might even experience an average wage decrease. Turning to equation 2 we see that workers with a given wage level are more likely to move the higher their current transportation costs are. Higher transportation costs make the worker lower his reservation wage, since potentially he could save the cost by moving to a new job location. Looking at equation 3 one can see that the lower the current wage, the higher is the probability of moving both job and residence. This is the case since the worker has to amortize the cost of moving, which only pays off if the wage increase is large. We also see that the further away from home one is working, the higher is the probability of making a residential move. This is because the reservation wage for moving is effectively lowered by higher transportation costs, which can be saved if the worker moves. Also the wage in the new job should not depend on the location of the job, i.e., the wage increase for those that move should not depend on how far away they move. Looking at figure 1 one notices that those who change job and move have higher wage increases than those who just change jobs without moving. This is so since moving is only a valid option if the wage is really high.

3 Data

The data used in the empirical analysis is that of the Danish register-based matched employer-employee data set IDA covering the period 1985 to 2003.[5] IDA contains annual socioeconomic information on workers and background information on employers, and it covers the entire Danish population. For the last week in November we observe the worker. If he is working, we observe in which firm and at which workplace he is employed. The data also contains earnings information which consists of the annual average hourly wage in the job occupied in the last week of November. In order to be clear a firm potentially consists of multiple workplaces, while a workplace can only belong to one firm. The distinction is important for the following definition of job-to-job transitions. Importantly, the data also contains information on the municipality of residence and of the workplace. These are the variables used to proxy locational choices. The data set is merged with detailed spell data on individual labor market histories.

The spell data consists of a worker and an employer id, start and end date of the spell, a variable

[5] IDA: *Integreret Database for Arbejdsmarkedsforskning* (Integrated Database for Labor Market Research) is constructed and maintained by Statistics Denmark.

describing the state of the worker. The spell data is constructed from administrative registers with information on public transfers, earnings, start and end dates for all jobs reported by firms to the Danish Tax Authorities, and mandatory employer pension contributions. To make the data more suitable for this study, I manipulate it in the following ways. There are sixteen states the worker can occupy in the raw data. These are aggregated into five states; employed (E), unemployed (U), nonparticipating (N), self-employed (S), and retired (O). Temporary non-participation and unemployment spells (shorter than 13 weeks) where the previous and next employer are identical are perceived as one employment spell. Similarly, non-participation and unemployment spells shorter than 3 weeks where the previous and the next employer are different are recorded as two employment spells where the in-between unemployment spell is included in the later employment spell. The spell data is used to control that the worker really has made a job-to-job transition and not been unemployed in between jobs.

3.1 Sample Selection

I disregard workers with invalid information, such as gaps in their spell history. These constitute only a very small number of individuals (less than one percent). Next, I define labor market entry to be the month of graduation from the highest completed education recorded in the data.[6] I delete observations before this date. If the worker is observed in education after the date of highest completed education, the worker is disregarded. For instance, workers who attend college but whose highest completed education is high school are deleted from the data since their highest education is high school but they still are observed in education (college). Notice, that if these workers had completed college, then their highest education would have been college and not high school and so they would not have been deleted. I also censor workers when they turn 55 years. This is done so I do not have to worry about retirement. This leaves me with 2.254.338 workers and 27.296.195 wage observations. I disregard workers with missing residential municipality, missing workplace municipality, missing hourly wage, missing educational information or missing firm id. This leaves me with 2.229.818 workers and 26.967.815 wage observations. I construct potential experience (see

[6] We only have information on the highest completed education back to 1969, so it is missing for workers who took it before 1969. Also, immigrants and workers who never finished primary school have missing values. We keep these workers in the data set since we believe that the problems with immigrants and workers who never finished primary school are quite small, and workers who finished their education before 1969 have already entered the labor market in 1988.

appendix) and disregard workers with negative potential experience. Finally, I delete worker-years, where the worker is either self-employed, unemployed, nonparticipating or retired. This leave me with my final sample of 2.206.577 workers and 21.149.319 wage observations. Table 1 shows the descriptive statistics for the different samples used in the empirical analysis.

[Insert table 1 here]

In the analysis I use three different samples in order to investigate whether or not the predictions made by the model hold in the data. The first sample is used for analyzing wage regressions. In these the unit is a worker in a given year. This gives me 21.149.319 observations. The key variable in the first sample is the dependent variable of log hourly wages. I use two different sets of variables to proxy the length between the workplace and residential home. The first set uses two measures of commuting time. Whether or not the worker is working and living in different municipalities and in different counties. In Denmark counties consist of a grouping of municipalities. So, if the worker is working and living in different counties, he is also living and working in different municipalities. The second set uses the distance in kilometers (km) between the workplace municipality and the residential municipality.[7]

In the second sample I study mobility patterns of workers. More specifically, I study job-to-job transitions and job-to-job transitions jointly with a residential move. I have therefore limited the sample to employed workers who have been employed for two consecutive years without being non-employed in between. This limits the sample to 17.743.917 observations. The two dependent variables are whether or not the worker is making a job-to-job transition between two years and if he is making a job-to-job transition jointly with a residential move. A job-to-job transition is defined as a move between two firms within a year where the worker has not been non-employed. The variables of interest are the wage and the two sets of proxies for distance between workplace and residence. Finally, the last sample is for estimating wage growth between two years for individuals making a job-to-job transition. The sample is therefore a sub-sample of the previous, i.e., I limit the sample to employed workers that have been employed for two consecutive years without being non-employed in between and have made a job-to-job transition. This limits the sample to 2.464.489 observations. The dependent variable is going to be yearly wage changes. There are going to be

[7] The distance is calculated from the center of one municipality to the center of the other.

three independent key variables. The first pertains to whether or not the old and the new workplace are located in different municipalities. The secondly delineates whether the worker changed from a workplace outside the residential county to one inside it. And the third regards whether or not the worker changed both workplace county and residential county.

4 Results

This section reviews whether predictions made by the theoretical model hold in the data. The first subsection relates to wage levels, the second to mobility patterns, and the third relates to the predictions regarding wage changes when making transitions in the labor and residential markets.

4.1 Wage Regression

According to the theory put forward, workers working farther away from home should on average have higher wages. This is due to compensating differentials in the sense that a worker do not accept low wage jobs if these are located far away from his current residential location. In table 2 the results from an OLS regression of log wages on two different sets of measures of distance between the workers workplace and his residential location are reported.

[Insert table 2 here]

The regressions are performed both with and without covariates and with and without residential and workplace municipality fixed effects and worker fixed effects. First, looking at the regressions using whether or not the workplace and the residence are in different municipalities and counties, I find that both coefficients on the proxies of distance are positive and significant and rather large. We can see that they drop when we start to control for individual heterogeneity and fixed effects. But even controlling for individual heterogeneity does not eliminate the wage premium. Living and working in different municipalities, but not in different counties, is associated with a wage premium of 1.2 percent, while living and working in different counties is associated with a wage premium of 2.4 percent. So the farther away from home one is working, the higher is the wage premium. Using the average commuting distance between workplace and residential municipalities gives similar results. For all levels of distance, increasing the distance, increases the wage premium.

Workers commuting more than 60 km earn on average 3.4 % more than those living and working the in the same municipality.

This is in accordance with the theory of increased reservation wages due to increased transportation costs. As already mentioned in the introduction, the fact the commuting time is positively related to wages is widely established in the literature already, e.g., see Timothy and Wheaton (2001). In order to compare the estimate, I will need to do some calculations. As an example let us take a worker with a commuting distance of 17.5 km. If we assume an eight hour work day and that the worker spends 1 hour transporting himself 60 km, then the value-of-time of commuting is $8 \cdot 0.013 \cdot 35/60 = 0.178$ times the wage rate. This is a lot smaller than Timothy and Wheaton (2001) who report estimates of 1.6 to 3. However, their estimates also include direct money expenses of commuting. Miller (1989) also reports estimates below the value of 1. Looking at the development of the estimates over the different specifications one should also notice that they drop to a tenth of the original estimate suggesting that controlling for individual heterogeneity and fixed effects are very important. Using the raw estimate from the data I get the results that the value-of-time of commuting is 1.7 times the wage rate thus suggesting that the current value-of-time of commuting is somewhat upward biased.

4.2 Job-to-Job Transitions

The model also relates the level of wages with the probability of making a job-to-job transition. The lower the current wage, the higher the probability of making a job-to-job transition and a job-to-job transition jointly with a residential move. The intuition in both cases is simply that the reservation wage is smaller both for a job-to-job transition and for a job-to-job transition jointly with a residential move. Since low wage individuals have lower reservation wages they accept more job offers. Empirically the question is in what way one would define the current wage. Taking the model to the extreme, all workers are ex ante homogenous and therefore comparable. However, most workers are not homogenous and taking heterogeneity into account seems to be a good idea. The most straight forward way to do this is to control for individual covariates and worker fixed effects while still including the wage. The coefficient on wages is going to reflect the effect of wages conditional on observed characteristics, i.e., if a worker earns a high wage given his education, position in the firm, experience etc. If the coefficient is negative, this means that a high wage worker conditional on observed characteristics has a lower probability of making a job-to-job transition, which would be in accordance with the theory. Table 3 shows the results for the probability of making a job-to-job transition.

[Insert table 3 here]

Just regressing on wages yields a small positive and significant coefficient on wages. However, after controlling for individual characteristics one can see that higher paid workers have a lower probability of making a job-to-job transition just as outlined in the model. This probably reflects the fact the high ability workers have both higher wages and are more likely to switch jobs. After controlling for both covariates and the fixed effects, the coefficient on log wages is minus 0.051. The standard deviation of wages is 0.38, so a one standard deviation increase in wages leads to a 1.9 percentage point drop in the probability of making a job-to-job transition in a given year. This is a rather large effect, since the probability of making a job-to-job transition is 13.9 percent.

I now turn to the probability of making a job-to-job transition jointly with a residential move in table 3. According to the model, workers with a high wage would make less frequent residential moves since they have higher reservation wages. Therefore they need a really high wage offer in order to be willing to pay the moving cost c. This is confirmed in table 3 where all the coefficients on wages across different specifications are negative ranging from minus 0.007 to 0. In the specification with both worker fixed effects and covariates the effect is minus 0.006. At first this might seem like a small effect, but keep in mind that the probability that a worker makes a job-to-job transition jointly with a residential move is less than one percent per year.

The model also related distance between the current job and residence to the probability of making a job-to-job transition. Specifically, workers with large distance between workplace and residence should have a higher probability of making a job-to-job transition. This is driven by the fact that higher transportation costs are going to effectively lower the reservation wage of the worker, thereby making him accept job offers more frequently. This holds both for workers who only make job-to-job transitions and workers **who** make a joint job-to-job transition with a residential move. Table 4 shows the results from an OLS regression of the probability of making a job-to-job transition on the two different sets of proxies for distance between residence and workplace.

[Insert table 4 here]

In all specifications of the model living and working in different municipalities is associated with a higher probability of making a job-to-job transition. The results vary from 2.1 to 3.2 percent. Controlling for individual heterogeneity in the form of covariates and worker fixed effects makes the estimates smaller. However, they are still relatively large and strongly significant. In the regression where both individual time varying covariates and worker fixed effects are taken into account, the effect is 2.1 percent. This is a very high effect since an average of 14 percent of the workers make a job-to-job transition each year. If the workplace and the residence are located in different counties, then the probability is even higher ranging from 6.8 to 4.0 percent. This means that a relatively large proportion of the job-to-job transitions we observe are driven by factors influenced by spatial considerations. If everyone worked in the municipality in which they live, job-to-job transitions would fall by 4 percentage points compared to a world were everyone work and live in different counties. Turning to the second set of proxies, i.e., the measure of commuting distance, I find that for almost all specifications there is an increasing probability of making a job-to-job transition as the distance increases. It is reassuring to see that not only working and living in different municipalities have an effect, but also that the proxies for increasing distance are positive. After controlling for both covariates and the fixed effects, we can see that a worker who works more than 60 km away from home has a 9.3 percentage point higher probability of making a job-to-job transition compared to a worker working in his residential municipality.

Table 5 contains the estimates when regressing a job-to-job transition jointly with a residential move on proxies for the distance between residence and workplace location.

[Insert table 5 here]

The results here are a little mixed. The effect of living and working in different counties on the propensity to make a residential move jointly with a job-to-job transition are positive. However, when the workplace and residential locations are in different municipalities, the effect is actually reversed. Turning to the proxies of commuting distance the pattern is somewhat confirmed. At low distances the results are a little fuzzy. However, when the distance becomes more than 40 km, then there is a much higher probability. One explanations for these findings is that a short commuting distance does not effect the probability to move. However, once the distance between workplace and residence becomes sufficiently high, then the worker takes this aspect into consideration.

4.3 Wage Changes

According to the structural model presented, workers should have a higher wage increase if they made a job-to-job transition which made the distance between the workplace and residential location increase. This happens in the model since workers who accept jobs farther away from home, but do not move, have higher reservation wages, since they want compensation for the increased cost of transportation. On the other hand job-to-job transitions which made the distance between the workplace and residential location smaller would on average have smaller wage increases than job-to-job transitions in general. The wage increase could even turn into a decrease depending on the parameters of the model. The intuition is that worker's reservation wages are lower for job offers near their home since they can save transportation costs. Another prediction was that workers who make a job-to-job transition and move residential location on average get a higher wage increase than those who just make a job-to-job transition without moving residential location, because, for the worker to consider a residential move, which is costly, the job offer should be very good. From table 1 one can see that in the raw data those who make job-to-job transitions have on average a higher wage increase of 1.1 percent compared to those who stay with the same employer. Table 6 shows the results from OLS regressions of wage increases between two years. The regression is run only for workers who have made a job-to-job transition between two consecutive years. The main variables of interest are three dummies indicating 1) whether or not the worker has changed workplace county when changing job, 2) whether or not the work county has been changed to the residential county, and finally 3) whether or not both the work county and the residential county has been changed. The model is estimated in four different specifications, and the coefficients do not change sign between them, although they do change size.

[Insert table 6 here]

The reference group in the estimation consists of workers making a job-to-job transition within their current workplace county. As predicted by the model, making a job-to-job transition where one changes workplace county is associated with a higher wage increase than average. In the raw data the average wage increase is 5.7 percent for individuals making a job-to-job transition. When the job-to-job transition is associated with a change in workplace county the wage increase is on average 0.1 to 1 percent higher depending on which specification used. This is a relatively high effect. However, if the workplace is changing from outside to inside the residential county, then the wage actually decreases. This conclusion also holds over all specifications. The combined effect is approximately a wage decrease of 1.5 percent. Notice that this is consistent with the model, although the model cannot label the sign of the wage change when moving closer to home since there are two different forces at work. The worker is willing to accept a wage cut, but on the other hand the wage offer is random and he might also draw a high offer. However, in the regression there is a substantial wage drop following a job-to-job transition changing the workplace from outside to inside the residential county. From table 1 one can see that 12 percent of all job-to-job transitions are of this kind. Thus, compensating differentials in the form of transportation costs seems to offer a potential explanation for the fact that a substantial part of job-to-job transitions are associated with a wage decrease, which is contradicted by standard search models. Finally, the last prediction by the model was that workers who jointly make a job-to-job transition and a residential move have the highest wage increases on average, because workers reject low wage offers from jobs that require them to move since they need to be compensated for the cost of moving residence. This is also confirmed by table 6. If the worker is both making a job-to-job transition to a different county and is moving to a different county, this is associated with an even higher wage premium than if only the workplace county is changed. The wage increase is on average 0.5 to 4.6 percent higher than for workers not changing workplace county. So all three predictions about wage changes seems to hold in the data.

5 Conclusion

This paper has proposed a simple way of incorporating a spatial dimension into a standard partial on-the-job search model in order to understand the joint decision of workplace location and residential location. The model offers a lot of predictions which are tested using Danish data. I find that workers with higher distances between home and workplace tend to earn higher wages. In the model this is due to higher reservation wages for workplace locations farther away from home. I find the timevalue of commuting time to approximately 0.2 times the wage rate. This is substantially lower than previous estimates from the literature. I find that controlling extensively for individual heterogeneity leads to much lower effects, suggesting that the higher timevalue of commuting time estimated in the literature could be due to the fact that studies use less control variables, see e.g. Timothy and Wheaton (2001). Specifically, using within worker variation seems to be important.

The model also puts forward predictions regarding the propensity to make job-to-job transitions. The probability of making a job-to-job transition and a job-to-job transition jointly with a residential move is highest for low wage workers. Low wage workers simply have lower reservation wages and therefore tend to accept job offers more frequently. Workers who work farther away from home have lower reservation wages since they currently have higher transportation costs. This should theoretically result in more job-to-job transitions. This is also confirmed if we look at workers working in counties which are not the ones they live in. However, this is not the case for worker's only working in a different municipality.

Finally, the model holds predictions about the realized wage change when workers made job-to-job transitions. Workers who made a job-to-job transition in which they changed workplace county experienced a higher wage increase than those who do not change workplace county. Again, the model predicts this since the workers who change workplace county have a higher reservation wage, since they need to be compensated for the added transportation costs. However, if the workplace county is changed to the residential county, then the wage increase actually becomes a decrease. This is a new finding, and potentially one which can help explain why so many job moves are associated with a wage decrease. Finally, workers who experience both a job-to-job transition and a residential move have the highest wage increases on average. This is also predicted by the model since a residential move is costly and therefore has the highest reservation wage.

This paper has thus set up a spatial search model with on-the-job search. The model predictions regarding wage changes and mobility patterns are confirmed using Danish matched employer-employee data. In future research, it would be interesting to extend this framework in an equilibrium model, thus allowing for policy evaluations of subsidies for transportation, urban structure and the like. However, this is beyond the scope of the present paper.

References

[1] Brueckner, J. and Y. Zenou, 2003. "Space and Unemployment: The Labor-Market Effects of Spatial Mismatch," *Journal of Labor Economics*, University of Chicago Press, vol. 21(1), pages

242-241, January.

[2] Clark, W. and Y. Huang, 2004. “Black and White Commuting Behaviour in a Large Southern City: Evidence from Atlanta,” *Geographical Analysis*, 36, 54–68.

[3] Clark, W., Huang, Y. and S. Withers, 2003. “Does Commuting Distance Matter? Commuting Tolerance and Residential Change,” *Regional Science and Urban Economics*, 33, 199–221.

[4] Dey, M. and C. Flinn, 2005. "An Equilibrium Model of Health Insurance Provision and Wage Determination". *Econometrica*,73, 571-627.

[5] Gautier, P., van Vuuren, A. and C.N. Teulings, 2010. "On the job search mismatch and efficiency". *Review of Economic Studies*, 77-1, 245-272.

[6] Madden, J. F. and Lee-in C. Chiu, 1990. "The Wage Effects of Residential Location and Commuting Constraints on Employed Married Women". *Urban Studies*, Vol. 27, p. 353-369.

[7] Manning, A., 2003. “The Real Thin Theory: Monopsony in Modern Labour Markets,” *Labour Economics*, 10, 105–131.

[8] Marimon R. and F. Zilibotti, 1999. "Unemployment vs. mismatch of talents: reconsidering unemployment benefits". *Economic Journal*, 109 266-291.

[9] Miller, T. R., 1989. "The value of time and the benefit of time saving", mimeo, The Urban Institute, July 1989.

[10] Nagypal, Eva, 2005. "On the Extent of Job-to-Job Transitions". Unpublished manuscript.

[11] Postel-Vinay, F. and J.-M. Robin, 2002, “Wage Dispersion with Worker and Employer Heterogeneity”, *Econometrica*, 70(6), 2295-350.

[12] Smith, T. and Y. Zenou, 2003. "Spatial mismatch, search effort and urban spatial structure", *Journal of Urban Economics*, Volume 54, Pages 129-156

[13] Taber, C. and R. Vejlin, 2010. "Sources of Wage Inequality", Unpublished manuscript

[14] Timothy, D. and W. C. Wheaton, 2001. "Intra-Urban Wage Variation, Employment Location, and Commuting times". *Journal of Urban Economics*, 50, 338-366

[15] Van Ommeren, J., 2000. “Job and Residential Search Behaviour of Two-Earner Households,” *Papers in Regional Science*, 79, 375–391

[16] Van Ommeren, J., Rietveld, P. and P. Nijkamp, 2000. "Job mobility, residential mobility and commuting: A theoretical analysis using search theory", *The Annals of Regional Science*, Volume 34, Number 2

[17] Y. Zenou, 2009. "Search in Cities". *European Economic Review*, Volume 53, p. 607-624

[18] Y. Zenou, 2010. "Search, wage posting, and urban spatial structure", *Journal of Economic Geography*, forthcoming

Derivation of reservation wages and locations

Indifferent between rejecting a job offer and accepting the job, but not moving residential location

The value of rejecting the job offer is just

$$\begin{aligned} rW(w,h,l) &= w - t(d(l,h)) - \delta(W(w,h,l) - U(h)) \\ &\quad + \lambda \int_0^1 \int_{\underline{w(l)}}^{\overline{w(l)}} \max(0, W(x,h,y) - W(w,h,l), W(x,y,y) - c - W(w,h,l)) dF(x,y) \end{aligned}$$

and the value of accepting the job offer at a wage $\widetilde{w}$ at location $\widetilde{l}$, but not moving residence is

$$\begin{aligned} rW(\widetilde{w},h,\widetilde{l}) &= w - t(d(\widetilde{l},h)) - \delta(W(\widetilde{w},h,\widetilde{l}) - U(h)) \\ &\quad + \lambda \int_0^1 \int_{\underline{w(l)}}^{\overline{w(l)}} \max(0, W(x,h,y) - W(\widetilde{w},h,\widetilde{l}), W(x,y,y) - c - W(\widetilde{w},h,\widetilde{l})) dF(x,y) \end{aligned}$$

The worker is indifferent when $W(\widetilde{w},h,\widetilde{l}) = W(w,h,l)$. I.e.

$$\begin{aligned} & w - t(d(l,h)) - \delta(W(w,h,l) - U(h)) \\ & + \lambda \int_0^1 \int_{\underline{w(l)}}^{\overline{w(l)}} \max(0, W(x,h,y) - W(w,h,l), W(x,y,y) - c - W(w,h,l)) dF(x,y) \\ = \; & \widetilde{w} - t(d(\widetilde{l},h)) - \delta(W(\widetilde{w},h,\widetilde{l}) - U(h)) \\ & + \lambda \int_0^1 \int_{\underline{w(l)}}^{\overline{w(l)}} \max(0, W(x,h,y) - W(\widetilde{w},h,\widetilde{l}), W(x,y,y) - c - W(\widetilde{w},h,\widetilde{l})) dF(x,y) \\ = \; & w - t(d(\widetilde{l},h)) - \delta(W(w,h,l) - U(h)) \\ & + \lambda \int_0^1 \int_{\underline{w(l)}}^{\overline{w(l)}} \max(0, W(x,h,y) - W(w,h,l), W(x,y,y) - c - W(w,h,l)) dF(x,y) \\ \Downarrow & \\ & \widetilde{w} \\ = \; & w + t(d(\widetilde{l},h)) - t(d(l,h)) \end{aligned}$$

Indifferent between accepting the job and accepting the job offer and moving to the new location

As before the value of accepting the job offer at a wage $\widetilde{w}$ at location $\widetilde{l}$, but not moving residence is

$$\begin{aligned} rW(\widetilde{w},h,\widetilde{l}) &= \widetilde{w} - t(d(\widetilde{l},h)) - \delta(W(\widetilde{w},h,\widetilde{l}) - U(h)) \\ &+\lambda \int_0^1 \int_{\underline{w(l)}}^{\overline{w(l)}} \max(0, W(x,h,y) - W(\widetilde{w},h,\widetilde{l}), W(x,y,y) - c - W(\widetilde{w},h,\widetilde{l}))dF(x,y) \end{aligned}$$

while the value living at the new location $\widetilde{l}$ with the new job is

$$\begin{aligned} rW(\widetilde{w},\widetilde{l},\widetilde{l}) &= \widetilde{w} - t(d(\widetilde{l},\widetilde{l})) - \delta(W(\widetilde{w},\widetilde{l},\widetilde{l}) - U(h)) \\ &+\lambda \int_0^1 \int_{\underline{w(l)}}^{\overline{w(l)}} \max(0, W(x,\widetilde{l},y) - W(\widetilde{w},\widetilde{l},\widetilde{l}), W(x,y,y) - c - W(\widetilde{w},\widetilde{l},\widetilde{l}))dF(x,y) \end{aligned}$$

The worker is indifferent when $W(\widetilde{w},\widetilde{l},\widetilde{l}) - c = W(\widetilde{w},h,\widetilde{l})$. I.e.

$$\begin{aligned} & \widetilde{w} - t(d(\widetilde{l},h)) - \delta(W(\widetilde{w},h,\widetilde{l}) - U(h)) \\ & +\lambda \int_0^1 \int_{\underline{w(l)}}^{\overline{w(l)}} \max(0, W(x,h,y) - W(\widetilde{w},h,\widetilde{l}), W(x,y,y) - c - W(\widetilde{w},h,\widetilde{l}))dF(x,y) \\ = \; & \widetilde{w} - t(d(\widetilde{l},\widetilde{l})) - \delta(W(\widetilde{w},\widetilde{l},\widetilde{l}) - U(h)) \\ & +\lambda \int_0^1 \int_{\underline{w(l)}}^{\overline{w(l)}} \max(0, W(x,\widetilde{l},y) - W(\widetilde{w},\widetilde{l},\widetilde{l}), W(x,y,y) - c - W(\widetilde{w},\widetilde{l},\widetilde{l}))dF(x,y) - rc \\ \Downarrow & \\ & -t(d(\widetilde{l},h)) + \lambda \int_0^1 \int_{\underline{w(l)}}^{\overline{w(l)}} \max(0, W(x,h,y) - W(\widetilde{w},h,\widetilde{l}), W(x,y,y) - c - W(\widetilde{w},h,\widetilde{l}))dF(x,y) \\ = \; & \lambda \int_0^1 \int_{\underline{w(l)}}^{\overline{w(l)}} \max(0, W(x,\widetilde{l},y) - W(\widetilde{w},\widetilde{l},\widetilde{l}), W(x,y,y) - c - W(\widetilde{w},\widetilde{l},\widetilde{l}))dF(x,y) - (r+\delta)c \\ \Downarrow & \\ & t(d(\widetilde{l},h)) \\ = \; & (r+\delta)c - \lambda \left[\begin{array}{c} \int_0^1 \int_{\underline{w(l)}}^{\overline{w(l)}} \max(0, W(x,h,y) - W(\widetilde{w},h,\widetilde{l}), W(x,y,y) - c - W(\widetilde{w},h,\widetilde{l})) \\ - \max(0, W(x,\widetilde{l},y) - W(\widetilde{w},\widetilde{l},\widetilde{l}), W(x,y,y) - c - W(\widetilde{w},\widetilde{l},\widetilde{l}))dF(x,y) \end{array} \right] \end{aligned}$$

It is easy to see that

$$\int_0^1 \int_{\underline{w(l)}}^{\overline{w(l)}} \max(0, W(x,h,y) - W(\widetilde{w},h,\widetilde{l}), W(x,y,y) - c - W(\widetilde{w},h,\widetilde{l}))$$
$$- \max(0, W(x,\widetilde{l},y) - W(\widetilde{w},\widetilde{l},\widetilde{l}), W(x,y,y) - c - W(\widetilde{w},\widetilde{l},\widetilde{l}))dF(x,y) > 0$$

since $W(\widetilde{w},\widetilde{l},\widetilde{l}) > W(\widetilde{w},h,\widetilde{l})$.

Indifferent between rejecting the job offer and accepting the job offer and moving

The value of rejecting the job offer is defined by

$$\begin{aligned} rW(w,h,l) &= w - t(d(l,h)) - \delta(W(w,h,l) - U(h)) \\ &+ \lambda \int_0^1 \int_{\underline{w(l)}}^{\overline{w(l)}} \max(0, W(x,h,y) - W(w,h,l), W(x,y,y) - c - W(w,h,l))dF(x,y) \end{aligned}$$

The value of accepting the job offer at a wage $\widetilde{w}$ at location $\widetilde{l}$, but not moving residence is defined by

$$\begin{aligned} rW(\widetilde{w},\widetilde{l},\widetilde{l}) &= \widetilde{w} - t(d(\widetilde{l},\widetilde{l})) - \delta(W(\widetilde{w},\widetilde{l},\widetilde{l}) - U(h)) \\ &+ \lambda \int_0^1 \int_{\underline{w(l)}}^{\overline{w(l)}} \max(0, W(x,\widetilde{l},y) - W(\widetilde{w},\widetilde{l},\widetilde{l}), W(x,y,y) - c - W(\widetilde{w},\widetilde{l},\widetilde{l}))dF(x,y) \end{aligned}$$

The worker is indifferent when $W(w,h,l) = W(\widetilde{w},\widetilde{l},\widetilde{l}) - c$. I.e. when

$$\begin{aligned}
& w - t(d(l,h)) - \delta(W(w,h,l) - U(h)) \\
& +\lambda \int_0^1 \int_{\underline{w(l)}}^{\overline{w(l)}} \max(0, W(x,h,y) - W(w,h,l), W(x,y,y) - c - W(w,h,l)) dF(x,y) \\
= \; & \widetilde{w} - t(d(\widetilde{l},\widetilde{l})) - \delta(W(\widetilde{w},\widetilde{l},\widetilde{l}) - U(h)) \\
& +\lambda \int_0^1 \int_{\underline{w(l)}}^{\overline{w(l)}} \max(0, W(x,\widetilde{l},y) - W(\widetilde{w},\widetilde{l},\widetilde{l}), W(x,y,y) - c - W(\widetilde{w},\widetilde{l},\widetilde{l})) dF(x,y) - rc \\
\Downarrow \\
& \widetilde{w} \\
= \; & w - t(d(l,h)) + (r+\delta)c \\
& +\lambda \left[\begin{array}{c} \int_0^1 \int_{\underline{w(l)}}^{\overline{w(l)}} \max(0, W(x,h,y) - W(w,h,l), W(x,y,y) - c - W(w,h,l)) \\ - \max(0, W(x,\widetilde{l},y) - W(w,h,l) - c, W(x,y,y) - 2c - W(w,h,l)) dF(x,y) \end{array} \right]
\end{aligned}$$

Notice that

$$\begin{aligned}
& \int_0^1 \int_{\underline{w(l)}}^{\overline{w(l)}} \max(0, W(x,h,y) - W(w,h,l), W(x,y,y) - c - W(w,h,l)) \\
& - \max(0, W(x,\widetilde{l},y) - W(w,h,l) - c, W(x,y,y) - 2c - W(w,h,l)) dF(x,y) \\
> \; & 0
\end{aligned}$$

since for all combinations of x, y the first term in the max's are the same, the middle term and the last term is smaller in the last max since

$$\begin{aligned}
W(x,h,y) - W(w,h,l) &\geq W(x,\widetilde{l},y) - W(w,h,l) - c \\
W(x,h,y) &\geq W(x,\widetilde{l},y) - c
\end{aligned}$$

I.e. the value of living at two different locations is at the maximum c, otherwise the worker would have moved.

Proof of intersection in graphical presentation

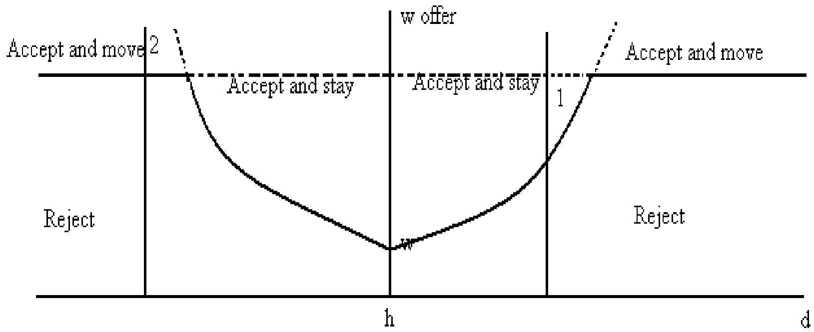

Figure 2: Illustration of proof

First a little short hand notation. AS is short for accepting and staying, AM is short for accepting and moving, R is short for rejecting, and $\succ$ means preferred to. Focus on the right hand side of the figure 2. Here the line denoting the indifference between AS and AM is drawn to the left of the intersection between the indifference curves of AS/R and AM/R. This results in a space appearing called 1. In this space it holds that AS$\succ$R, R$\succ$AM, and AM$\succ$A. This provides a logical inconsistency, so the line cannot be drawn to the left of the intersection. Now turn focus to the left side of the figure. Here the line denoting the indifference between AS and AM is drawn to the left of the intersection between the indifference curves of AS/R and AM/R. This results in a space appearing called 2. In this space it holds that R$\succ$AS, AM$\succ$R, and AS$\succ$AM. This provides a logical inconsistency, so the line cannot be drawn to the left of the intersection. Q.E.D.

Description of the data

The variables used in this study are register data from the Statistics Denmark. The variables that are not self-explanatory are described here.

Potential experience

Potential experience is calculated as age minus the number of years in school minus six, which is the starting age for children in the Danish school system, i.e. potential experience is the number of years since the worker left the educational system, if he went through it using the minimum number of years.

Position within the firm

This variable is divided into six non-overlapping categories; CEO's, Leading salaried employees, Salaried employees, Skilled, Non-skilled and Missing position. These categories are based on several registers, but the most important sources are the tax sheets from each employer which labels the position of the worker.

Educational group

The educational groups are divided into eight subcategories based on the length of education;7-9 years, 9-11 years, 12-13 years, 14 years, 15 years, 16-17 years, 18-19 years, 20+ years. 7-9 years corresponds to lower secondary. 9-11 years are high school dropouts and very short vocational educations. 12-13 years are high school graduates and those with longer vocational education. 14 years are short tertiary educations. 15 years are educations with a bachelor degree. 16-17 years are medium length educations, such as school teachers and nurses. 18-19 years are educations with a master degree and 20+ are graduate level/Ph.D. educations.

Tables

Table 1: Descriptive Statistics

	Descriptive stats for wage regressions			Descriptive stats for mobility regressions			Descriptive stats for wage change regressions		
	Mean	Std. Dev.	N	Mean	Std. Dev.	N	Mean	Std. Dev.	N
Log Hourly Wage	4.908	0.402	21,149,319	4.950	0.380	17,743,917	4.911	0.434	2,464,489
Job-to-job transition				0.139	0.346	17,743,917	1.000	0.000	2,464,489
Job-to-job transition and change work county				0.008	0.091	17,743,917			
Wage change				0.047	0.211	17,743,917	0.057	0.369	2,464,489
Change work county				0.054	0.227	17,743,917	0.281	0.450	2,464,489
Change work county to res. County				0.017	0.130	17,743,917	0.118	0.323	2,464,489
Change work county and res. County				0.008	0.087	17,743,917	0.044	0.205	2,464,489
Res. And workplace in different mun.	0.472	0.499	21,149,319	0.472	0.499	17,743,917	0.561	0.496	2,464,489
Res. And workplace in different counties	0.229	0.420	21,149,319	0.228	0.420	17,743,917	0.301	0.459	2,464,489
Commuting distance									
- Distance	12.238	26.882	21,148,785	11.896	25.964	17,743,867	17.017	33.642	2,464,468
- 0 km	0.540	0.498	21,149,319	0.541	0.498	17,743,917	0.456	0.498	2,464,489
- 0 - 5 km	0.015	0.123	21,149,319	0.016	0.124	17,743,917	0.015	0.123	2,464,489
- 5 - 10 km	0.083	0.276	21,149,319	0.084	0.277	17,743,917	0.088	0.284	2,464,489

- 10 - 15 km	0.092	0.289	21,149,319	0.093	0.291	17,743,917	0.099	0.299	2,464,489
- 15 - 20 km	0.075	0.263	21,149,319	0.075	0.264	17,743,917	0.081	0.273	2,464,489
- 20 - 30 km	0.092	0.288	21,149,319	0.092	0.289	17,743,917	0.108	0.311	2,464,489
- 30 - 40 km	0.037	0.188	21,149,319	0.037	0.188	17,743,917	0.048	0.215	2,464,489
- 40 - 60 km	0.031	0.173	21,149,319	0.030	0.171	17,743,917	0.043	0.204	2,464,489
- $>$ 60 km	0.035	0.184	21,149,319	0.033	0.178	17,743,917	0.060	0.237	2,464,489
Potential experience	20.924	10.074	21,149,319	20.673	9.727	17,743,917	17.564	10.015	2,464,489
Female	0.483	0.500	21,149,319	0.479	0.500	17,743,917	0.414	0.493	2,464,489
Positions									
- CEO	0.017	0.131	21,149,319	0.017	0.129	17,743,917	0.015	0.122	2,464,489
- Leading salaried employee	0.216	0.411	21,149,319	0.228	0.420	17,743,917	0.215	0.411	2,464,489
- Salaried employee	0.267	0.442	21,149,319	0.277	0.448	17,743,917	0.261	0.439	2,464,489
- Skilled	0.273	0.446	21,149,319	0.266	0.442	17,743,917	0.300	0.458	2,464,489
- Non-skilled	0.174	0.379	21,149,319	0.168	0.374	17,743,917	0.150	0.357	2,464,489
- Missing position	0.053	0.224	21,149,319	0.044	0.205	17,743,917	0.059	0.236	2,464,489
Educational group									
- 7-9 years	0.187	0.390	21,149,319	0.185	0.389	17,743,917	0.139	0.346	2,464,489
- 9-11 years	0.072	0.259	21,149,319	0.065	0.246	17,743,917	0.087	0.281	2,464,489
- 12-13 years	0.487	0.500	21,149,319	0.492	0.500	17,743,917	0.519	0.500	2,464,489
- 14 years	0.056	0.230	21,149,319	0.057	0.232	17,743,917	0.062	0.241	2,464,489
- 15 years	0.005	0.068	21,149,319	0.005	0.068	17,743,917	0.006	0.080	2,464,489
- 16-17 years	0.138	0.345	21,149,319	0.142	0.349	17,743,917	0.115	0.318	2,464,489
- 18-19 years	0.052	0.221	21,149,319	0.052	0.222	17,743,917	0.068	0.251	2,464,489

- 20+ years	0.003	0.053	21,149,319	0.003	0.053	17,743,917	0.004	0.064	2,464,489
Employer									
- Foreign	0.018	0.133	21,149,319	0.018	0.132	17,743,917	0.031	0.172	2,464,489
- Missing	0.004	0.060	21,149,319	0.003	0.059	17,743,917	0.004	0.066	2,464,489
- Association	0.082	0.275	21,149,319	0.083	0.276	17,743,917	0.079	0.270	2,464,489
- Municipality-County	0.232	0.422	21,149,319	0.232	0.422	17,743,917	0.100	0.300	2,464,489
- State	0.062	0.242	21,149,319	0.065	0.247	17,743,917	0.103	0.304	2,464,489
- Private	0.602	0.489	21,149,319	0.598	0.490	17,743,917	0.683	0.465	2,464,489
Industri									
- Agriculture	0.012	0.110	21,149,319	0.011	0.104	17,743,917	0.013	0.114	2,464,489
- Manufacturing	0.218	0.413	21,149,319	0.220	0.414	17,743,917	0.213	0.409	2,464,489
- Supply	0.000	0.000	20,961,236	0.000	0.000	17,575,362	0.000	0.000	2,449,511
- Construction	0.058	0.233	21,149,319	0.054	0.227	17,743,917	0.072	0.258	2,464,489
- Wholesale	0.150	0.357	21,149,319	0.149	0.356	17,743,917	0.179	0.383	2,464,489
- Transport and Communication	0.071	0.256	21,149,319	0.072	0.259	17,743,917	0.110	0.313	2,464,489
- Finance	0.126	0.332	21,149,319	0.128	0.334	17,743,917	0.156	0.363	2,464,489
- Public sector	0.350	0.477	21,149,319	0.350	0.477	17,743,917	0.246	0.431	2,464,489
- Missing	0.015	0.121	21,149,319	0.015	0.123	17,743,917	0.011	0.000	2,464,489
Civil status									
- Widow	0.010	0.098	21,149,319	0.009	0.094	17,743,917	0.007	0.081	2,464,489
- Divorced	0.080	0.271	21,149,319	0.077	0.266	17,743,917	0.072	0.258	2,464,489
- Married	0.611	0.488	21,149,319	0.620	0.485	17,743,917	0.528	0.499	2,464,489
- Single	0.001	0.030	21,149,319	0.293	0.455	17,743,917	0.001	0.031	2,464,489

- Other	0.299	0.458	21,149,319	0.001	0.029	17,743,917	0.393	0.488	2,464,489
Number of Children									
- Aged 0-2	0.131	0.364	21,149,319	0.131	0.363	17,743,917	0.155	0.392	2,464,489
- Age 3-6	0.179	0.436	21,149,319	0.183	0.439	17,743,917	0.187	0.445	2,464,489
- Aged 7-9	0.138	0.369	21,149,319	0.143	0.374	17,743,917	0.131	0.362	2,464,489
- Aged 10-14	0.243	0.512	21,149,319	0.254	0.520	17,743,917	0.212	0.486	2,464,489
- Aged 15-17	0.151	0.383	21,149,319	0.158	0.389	17,743,917	0.125	0.353	2,464,489

Table 2: OLS Wage Regression

	Est.	Std. Err.	Est.	Std. Err.	Est.	Std. Err.	Est.	Std. Err.
Res. And workplace in different mun.	0.1008*	0.1008	0.0154*	0.0002	0.0260*	0.0002	0.0117*	0.0002
Res. And workplace in different counties	0.1037*	0.1037	0.0115*	0.0002	0.0692*	0.0002	0.0124*	0.0002
Covariates	NO		NO		YES		YES	
Fixed effects	NO		YES		NO		YES	
Obs.	21,149,319		21,149,319		21,149,319		21,149,319	
Rsquared	0.0430		0.7484		0.4663		0.7530	

	Est.	Std. Err.	Est.	Std. Err.	Est.	Std. Err.	Est.	Std. Err.
Commuting distance								
- 0 km (reference)								
- 0 - 5 km	0.1010*	0.0007	0.0040*	0.0007	0.0666*	0.0005	-0.0001	0.0007
- 5 - 10 km	0.1174*	0.0003	0.0120*	0.0003	0.0610*	0.0002	0.0082**	0.0003
- 10 - 15 km	0.1151*	0.0003	0.0137*	0.0003	0.0438*	0.0002	0.0093*	0.0003
- 15 - 20 km	0.1205*	0.0003	0.0171*	0.0003	0.0399*	0.0003	0.0130*	0.0003
- 20 - 30 km	0.1586*	0.0003	0.0224*	0.0003	0.0553*	0.0002	0.0188*	0.0003
- 30 - 40 km	0.2035*	0.0005	0.0280*	0.0004	0.0709*	0.0004	0.0252*	0.0004
- 40 - 60 km	0.2242*	0.0005	0.0337*	0.0004	0.0764*	0.0004	0.0321*	0.0004
- > 60 km	0.2324*	0.0005	0.0341*	0.0004	0.0760*	0.0004	0.0335*	0.0004
Covariates	NO		NO		YES		YES	
Fixed effects	NO		YES		NO		YES	
Obs.	21,149,319		21,149,319		21,149,319		21,149,319	
Rsquared	0.0386		0.7485		0.4630		0.7530	

Notes:
'*', and '**' indicate significance at one and five percent level, respectively.
Covariates includes following variabes: Potential experience,
potential experience squared, female, dummies for educational level, position in the workplace,
type of employer (private, municipal, regional or state), industry, civil status,
number of children in different age groups, and yearly dummies.
Fixed effects include fixed effects for residential municipality, workplace municipality and individual fixed effects.

Table 3: OLS REGRESSION OF TRANSITIONS ON WAGES

	Probability to make a job-to-job transition							
	Est.	Std. Err.	Est.	Std. Err.	Est.	Std. Err.	Est.	Std. Err.
Log Hourly Wage	0.0072*	0.0002	-0.0516*	0.0004	-0.0539*	0.0003	-0.0511*	0.0004
Covariates	NO		NO		YES		YES	
Worker fixed effect	NO		YES		NO		YES	
Obs.	17,743,917		17,743,917		17,743,917		17,743,917	
Rsquared	0.00		0.22		0.04		0.22	
	Probability to make a job-to-job transition and a residential move							
	Est.	Std. Err.	Est.	Std. Err.	Est.	Std. Err.	Est.	Std. Err.
Log Hourly Wage	-0.0007*	0.0001	-0.0072*	0.0001	-0.0054*	0.0001	-0.0058*	0.0001
Covariates	NO		NO		YES		YES	
Worker fixed effect	NO		YES		NO		YES	
Obs.	0		0		0		0	
Rsquared	0.00		0.20		0.01		0.21	

Notes:
'*', and '**' indicate significance at one and five percent level, respectively.
Covariates includes following variabes: Potential experience,
potential experience squared, female, dummies for educational level, position in the workplace,
type of employer (private, municipal, regional or state), industry, civil status,
number of children in different age groups, and yearly dummies.
Fixed effects include fixed effects for residential municipality, workplace municipality and individual fixed effects.

Table 4: OLS REGRESSION OF JOB-TO-JOB TRANSITION ON DISTANCE

	Probability to make a job-to-job transition							
	Est.	Std. Err.	Est.	Std. Err.	Est.	Std. Err.	Est.	Std. Err.
Res. And workplace in different mun.	0.0324*	0.0002	0.0233*	0.0004	0.0225*	0.0002	0.0206*	0.0004
Res. And workplace in different counties	0.0352*	0.0002	0.0201*	0.0004	0.0170*	0.0002	0.0194*	0.0004
Covariates	NO		NO		YES		YES	
Worker fixed effect	NO		YES		NO		YES	
Obs.	17,743,917		17,743,917		17,743,917		17,743,917	
Rsquared	0.01		0.22		0.04		0.22	

	Est.	Std. Err.	Est.	Std. Err.	Est.	Std. Err.	Est.	Std. Err.
Commuting distance								
- 0 km (reference)								
- 0 - 5 km	0.0178*	0.0007	0.0070*	0.0012	0.0130*	0.0007	0.0050*	0.0012
- 5 - 10 km	0.0290*	0.0003	0.0109*	0.0006	0.0128*	0.0003	0.0086*	0.0006
- 10 - 15 km	0.0311*	0.0003	0.0176*	0.0005	0.0186*	0.0003	0.0151*	0.0005
- 15 - 20 km	0.0330*	0.0003	0.0215*	0.0006	0.0212*	0.0003	0.0189*	0.0006
- 20 - 30 km	0.0468*	0.0003	0.0286*	0.0005	0.0301*	0.0003	0.0259*	0.0005
- 30 - 40 km	0.0674*	0.0004	0.0425*	0.0007	0.0439*	0.0004	0.0394*	0.0007
- 40 - 60 km	0.0831*	0.0005	0.0576*	0.0008	0.0559*	0.0005	0.0539*	0.0008
- > 60 km	0.1356*	0.0005	0.0973*	0.0007	0.1018*	0.0005	0.0927*	0.0007
Covariates	NO		NO		YES		YES	
Worker fixed effect	NO		YES		NO		YES	
Obs.	17,743,917		17,743,917		17,743,917		17,743,917	
Rsquared	0.01		0.22		0.04		0.22	

Notes:
'*', and '**' indicate significance at one and five percent level, respectively.
Covariates includes following variabes: Potential experience,
potential experience squared, female, dummies for educational level, position in the workplace,
type of employer (private, municipal, regional or state), industry, civil status,
number of children in different age groups, and yearly dummies.
Fixed effects include fixed effects for residential municipality, workplace municipality and individual fixed effects.

Table 5: OLS regression of job-to-job and residential transition on Distance

	Probability to make a job-to-job transition and a residential move							
	Est.	Std. Err.	Est.	Std. Err.	Est.	Std. Err.	Est.	Std. Err.
Res. And workplace in different mun.	-0.0008*	0.0001	-0.0013*	0.0001	-0.0011*	0.0001	-0.0014*	0.0001
Res. And workplace in different counties	0.0079*	0.0001	0.0040*	0.0001	0.0059*	0.0001	0.0039*	0.0001
Covariates	NO		NO		YES		YES	
Worker fixed effect	NO		YES		NO		YES	
Obs.	17,743,917		17,743,917		17,743,917		17,743,917	
Rsquared	0.00		0.20		0.01		0.21	
	Est.	Std. Err.	Est.	Std. Err.	Est.	Std. Err.	Est.	Std. Err.
Commuting distance								
- 0 km (reference)								
- 0 - 5 km	0.0001	0.0002	-0.0009*	0.0003	-0.0006*	0.0002	-0.0009*	0.0003
- 5 - 10 km	0.0019*	0.0001	-0.0013*	0.0001	0.0006*	0.0001	-0.0014*	0.0002
- 10 - 15 km	0.0009*	0.0001	-0.0009*	0.0001	0.0002**	0.0001	-0.0010*	0.0001
- 15 - 20 km	0.0000	0.0001	-0.0010*	0.0001	-0.0004*	0.0001	-0.0011*	0.0002
- 20 - 30 km	0.0012*	0.0001	-0.0005*	0.0001	0.0003*	0.0001	-0.0007*	0.0001
- 30 - 40 km	0.0030*	0.0001	0.0004*	0.0002	0.0012*	0.0001	0.0001	0.0002
- 40 - 60 km	0.0049*	0.0001	0.0020*	0.0002	0.0029*	0.0001	0.0017*	0.0002
- $>$ 60 km	0.0132*	0.0001	0.0101*	0.0002	0.0110*	0.0001	0.0097*	0.0002
Covariates	NO		NO		YES		YES	
Worker fixed effect	NO		YES		NO		YES	
Obs.	17,743,917		17,743,917		17,743,917		17,743,917	
Rsquared	0.00		0.20		0.01		0.21	

Notes:
'*', and '**' indicate significance at one and five percent level, respectively.
Covariates includes following variabes: Potential experience,
potential experience squared, female, dummies for educational level, position in the workplace,
type of employer (private, municipal, regional or state), industry, civil status,
number of children in different age groups, and yearly dummies.
Fixed effects include fixed effects for residential municipality, workplace municipality and individual fixed effects.

Table 6: OLS Wage Growth Regression for Job-to-Job movers

	Est.	Std. Err.	Est.	Std. Err.	Est.	Std. Err.	Est.	Std. Err.
Change work County	0.0097*	0.0011	0.0012	0.0014	0.0021**	0.0011	0.0061*	0.0014
Change work County to res. County	-0.0434*	0.0008	-0.0200*	0.0009	-0.0372*	0.0008	-0.0207*	0.0009
Change work county and res. County	0.0458*	0.0006	0.0044*	0.0008	0.0308*	0.0006	0.0049*	0.0008
Covariates	NO		NO		YES		YES	
Fixed effects	NO		YES		NO		YES	
Obs.	2,464,489		2,464,489		2,464,489		2,464,489	
Rsquared	0.1848		0.6938		0.2794		0.6963	

Notes:
'*', and '**' indicate significance at one and five percent level, respectively.
Covariates includes following variabes: Potential experience,
potential experience squared, female, dummies for educational level, position in the workplace,
type of employer (private, municipal, regional or state), industry, civil status,
number of children in different age groups, and yearly dummies.
Fixed effects include fixed effects for residential municipality, workplace municipality and individual fixed effects.

Economics Working Paper

2010-2: Allan Sørensen: Welfare Effects of Trade Liberalization with Intra-industry Reallocations: The Importance of Preferences and Market Failures

2010-3: Marianne Simonsen, Lars Skipper and Niels Skipper: Price Sensitivity of Demand for Prescription Drugs: Exploiting a Regression Kink Design

2010-4: Torben M. Andersen and Allan Sørensen: Product market integration, rents and wage inequality

2010-5: John Kennes and Daniel le Maire: Coordination Frictions and Job Heterogeneity: A Discrete Time Analysis

2010-6: Philipp J.H. Schröder and Allan Sørensen: The Theoretical Equivalent of Empirically Measurable Exporter Productivity when Firms are Heterogeneous

2010-7: Nabanita Datta Gupta and Marianne Simonsen: Effects of Universal Child Care Participation on Pre-teen Skills and Risky Behaviors

2010-8: Olaf Posch and Timo Trimborn: Numerical solution of continuous-time DSGE models under Poisson uncertainty

2010-9: Torben M. Andersen and Allan Sørensen: Globalization, tax distortions and public sector retrenchment

2010-10: Philipp J.H. Schröder and Allan Sørensen: Ad valorem versus unit taxes: Monopolistic competition, heterogeneous firms, and intra-industry reallocations

2010-11: Søren Leth-Petersen and Niels Skipper: Income and the use of prescription drugs for near retirement individuals

2010-12: Niels Skipper: On Utilization and Stockpiling of Prescription Drugs when Co-payments Increase: Heterogeneity across Types of Drugs

2010-13: Kenneth L. Sørensen and Rune M. Vejlin: Worker and Firm Heterogeneity in Wage Growth: An AKM approach

2010-14: Rune Vejlin: Residential Location, Job Location, and Wages: Theory and Empirics