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Commuting time and wages. Evidence from Hungary

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ABSTRACT

The paper explores the hypothesis that high costs of commuting are responsible for the persistent unemployment rate of Hungarian villages. An attempt is made to estimate the compensating wage differential associated with commuting time using individual-level data, taken from a survey conducted among unemployed in 2001. We find a positive relationship between commuting time and wages: an hour increase in travel time is associated with a 11.6 percent increase in wages. After controlling for individual and firm characteristics, the effect of commuting time becomes smaller. Wages seem to compensate for commuting time only if the employer reimburses travel expenses. Workers in seasonal jobs also get a wage premium which seem to compensate for commuting costs. The results indicate that in the absence of reimbursement of travel expenses, commuting costs substantially constrain the employment chances of unemployed in non seasonal jobs.

Keywords: Commuting, Spatial Mismatch Hypothesis, Compensating Wages

JEL-classification: J31, J61, R20

1. INTRODUCTION

Although the unemployment rate shows a decreasing tendency in Hungary since 1994, it is still high in those villages where it was the highest (above 20 percent) in the mid 1990s. Similar to the logic of the well-known spatial mismatch hypothesis, which claims that the suburbanization of job opportunities accounts for the high unemployment rate among black inner-city residents (Kain 1992, Ihlanfeldt and Sjoquist 1998), it was proposed that the high costs of daily commuting to urban labor markets accounts for the high unemployment rates in villages (Köllő, 1997, 2006; Kertesi, 2000). Using a transportation database with settlements as units of observation, Köllő (1997, 2006) showed that in the absence of public transportation linkages, commuting with cars would use up a substantial part of the expected wages. Public transportation links are especially underdeveloped in regions where villages with high unemployment rates are typically situated. He also estimated lower-bounds of travel expenses. Kertesi (2000) relied on these estimates when analyzing the 1996 micro-census of the Hungarian Statistical Office and found that the probability of commuting decreased with commuting costs. He also found that low-skilled villagers were more severely constrained in commuting by transport costs than were their high-educated counterparts – a finding that motivates us to restrict the forthcoming analysis to low-skilled workers (those without college or university diploma).

The common problem of the above mentioned studies is that actual costs of commuting are estimated rather than observed. In this paper, we attempt to provide an estimate of the wage premium associated with commuting using individual-level information about commuting costs. We address the following questions: (1) Do wages increase with commuting time? (2) Does commuting time have a positive effect of wages? In other words: do commuters receive a compensating wage premium for costly commuting?

The positive relationship between wages and commute is often interpreted in terms of compensating wages (Leigh 1986, Zax 1991). However, most urban and labor economists find "compensating wage" a metaphor rather than a rigorous explanation. To urban economists, a relationship between wages and commuting distances indicates selective residential choices: high-wage employees chose a residential location (the suburb) far away from their job (located in the city center), while low-income employees live close to their jobs. The focus here is on the housing market. If there is any compensation, it is between housing prices and the costs of commuting: the costs of a longer commute are justified if housing prices become lower. Labor economists, on the other hand, explain the correlation between commutes and wages using search theory. The basic idea is that only those wage offers are acceptable that exceed the

reservation wage. Since commuting is costly, the reservation wage should increase in distance or commuting time (Rouwendal 1998, Manning 2003). Hence, observed wages should be positively related to commuting time. This paper tries to contribute to the labor market explanation: we are interested in knowing how commuting distance affects job acceptance and wage posting decisions.

Our research questions are examined using data on prospective and previous jobs of unemployed who are registered at Employment Offices. On the one hand, this is a natural choice since our aim is to account for persistent unemployment. On the other hand, the data allow us to exclude the residential choice explanation because the poor is unlikely to move. The unique feature of the housing market is that the vast majority, 96 percent of houses are owner-occupied. Housing transactions involve substantial transaction costs and a bad decision may put more than the annual income at risk (Hegedűs 1994). Moving is more characteristic for high-income families, which is evidenced in the suburbanization process especially around the capital city Budapest (loosing about 15 percent of population during the 1990s), but also around other large towns. We therefore expect that unemployed people will first think of commuting instead of moving as the means of improving their economic condition.

The remainder of the paper is organized as follows. The next section describes the data and variables used in the subsequent sections. Section 3 examines the empirical relationship between commuting time and wages. The question whether the observed relationship is a "causal" one is the subject of Section 4. Using cross-sectional and fixed-effects estimation methods, we estimate of the net effect of commuting time on wages. Section 5 concludes.

2. DATA

In April 2001, a survey was conducted among registered unemployed who were entitled to unemployment benefits (N=105,924) and got a job between 18 of March and 7 of April 2001. The primary purpose of data collection was the evaluation of the effect of the dramatic rise of the minimum wage on changes in unemployment. In the above mentioned period, 9474 people got a job, out of which 8339 people completed the questionnaire (Köllő, 2002). The questionnaire contains both retrospective questions about the previous job and questions about the new job. Information covers the characteristics of job and the firm, the names of the settlement where the job is located, place of residence, and commuting.

This paper will use a subset of the data, consisting of 2069 observations. Survey data are rarely free of data problems. In our dataset, two problems are of special interest. First, the

survey question related to the monetary costs of commuting was not posed for people who did not change their employer. Since commuting costs cannot be assumed to remain constant, these cases must be excluded. Our sample therefore is restricted to job changers. Second, when asked about the prospective job, respondents were asked to estimate the lower and the upper bounds of the salary. Unfortunately the reported minimums and maximums differ substantially in a considerable proportion of cases. Only those respondents enter our sample who gave the same estimate for both the lower and the upper bound, that is, they knew (or, more realistically, pretended to know) the exact value of their prospective salary.

The sample size was further reduced by the following decisions. Since our focus is on the effect of commuting, and migration might disturb the empirical relationship between commuting time and commuting decisions (Ihlanfeldt and Sjoquist, 1998), we exclude those unemployed who changed their place of residence during their unemployment spell. In order to minimize the occurrence of outlier data points that would have an enormous effect on regression coefficients we deleted observations where (1) wages are higher than 100 thousands Forint; (2) daily commuting time exceeds 3 hours; (3) college or university education is reported; or (4) work is not carried out under a regular employment relationship (that is, part-time work, traineeship or no employment relationship characterizes the work situation). Criteria (3) and (4) guarantee that, consistent with our purposes described in the Introduction, we study a labor market segment in which people with relatively low education are matched to regular jobs. In order to minimize recall biases, we deleted cases where last wage data are prior to October 2000. Finally, we deleted observations where any of our variables have missing values. These observations would be automatically excluded in regression analyses.

As a result of these decisions, we are left with 2069 observations for further analyses. Notice that this is not the number of observed individuals because, in principle, one person is observed twice. In our sample, there are 1334 observations about the previous job and 735 observations about the prospective job.

Appendix Table A1 lists the variables used in this study and the definitions thereof. Our interest centers on the relationship between wages and commuting costs. The hourly wage variable is the reported gross monthly salary divided by 200, meaning 25 working days per months and 8 working hours per day. Commuting time is the time spent on traveling on an average day. Instead of reporting actual travel costs, respondents were asked whether the firm reimburses part or the full amount of travel costs. Full reimbursement means that the firm either pays the costs or organizes the travel of employees at own expenses. Partial reimbursement means that an unknown part of travel expenses are reimbursed.

Besides these variables, our analyses will control for other wage determinants like human

capital, firm level characteristics and local unemployment rates. Human capital is captured by gender, education, and age. Education is a dummy variable taking the value 1 if the respondent has A-level and 0 if the respondent has only vocational or (some) elementary education. The type of occupation variable takes the value 1 if the respondent has a white-collar job and 0 if the respondent works in a manual occupation. Firm size records the number of employees at the firm. Local unemployment rate is the ratio of the number of unemployed to the number of economically active population in the place of work. Information about unemployment and economic activity are taken from the 2000 wave of the TSTAR database of the Hungarian Statistical Office. The TSTAR databases have settlements as observations and covers information about several economic, social and demographic variables. Finally, we will also control for the effect of the minimum wage, which was substantially raised in 2001. The year variable is a dummy which takes the value 1 if the last monthly wage variable is observed in 2001 and 0 if the year of observation is 2000 (see also below).

Table 1 shows the means and standard deviations of the variables used in subsequent analyses. An average worker spends almost one hour per day on travel to work and back to home. Half of the workers receive either partial or full reimbursement of travel expenses. Since data come from a survey conducted among those registered unemployed who found a job, it should not be surprising that only 20 percent of individuals have an A level and one our of then person has a white-collar job.

TABLE 1 ABOUT HERE

The average commuting time is similar to figures presented in other studies. Using Dutch aggregate statistics, van der Vlist (2001) reports an average commuting distance of 17.5 km among men and 11.0 km among women (the gross average being 15.3 km) for 1997. In Hungary, traveling 15 kilometers using public transportation involves about 30 minutes, so the one hour commuting time seems to be consistent with the Dutch findings. Using data from another Dutch survey conducted in 1998, Rouwendal and van Ommeren (2008) report an average of one hour for workers with reimbursement and half an hour for workers without reimbursement. Since 36% of the sample received reimbursement, the sample average is about 40 minutes. Almost the same figure, about 45 minutes is reported by Manning (2003) using the British Labour Force Survey for 1993-2001 and the British Household Panel Survey for 1991-2000. The similarity is striking because our sample does not contain people with high earnings, who tend to commute larger distances (see, for example, van der Vlist 2001).

3. THE RELATIONSHIP BETWEEN WAGES AND COMMUTES

Before making any attempt to explain the relationship between commuting and wages, we first examine the question whether there is any relationship to explain. Table 2 shows the distribution of daily commuting time and the correlation between wages, reimbursement and commuting time. The vast majority, almost 80 percent of workers do not travel more than one hour. This finding is consistent with estimates reported in other studies carried out in other countries. For Britain, Manning (2003) finds that about 80 percent of employees commute less than or equal to one hour. For the Netherlands, van Ommeren (1996) found that half of the workers commute less than 8 kilometers and only 10 percent of workers commute more than 32 kilometers. In terms of commuting time, half of the workers commute less than 20 minutes. (These estimates use the so-called *Enquete Beroepsvolking*, having been conducted in 1992.).

Hourly wages are positively correlated with commuting time. Those who travel 31-60 minutes earn more by 10 percent than those who travel 1-30 minutes. An additional half an hour increases the wages by another 5 percent. To summarize the results, a univariate linear regression of log hourly wages on commuting time was preformed. The parameter estimate of commuting time is 0.11 ($p<000$), which means that an hour increase in travel time is associated with a 11.6 percent increase in wages. Manning (2003) proposes a simple way of assessing the economic (not statistical) significance of this estimate. Assuming eight hours working days, the coefficient indicates full compensation for time-consuming commuting if it corresponds to a 12.5 percent increase in hourly wages. Our estimate is very close to this benchmark value.

TABLE 2 ABOUT HERE

This comparison, however, assumes that commuting does not involve monetary costs and correspondingly the commuting time variable measures only the time wasted on commuting. This assumption is clearly unrealistic. Notice that the majority of workers do not travel more than one hour, thus wages do not fully compensate for the total commuting costs. The estimates shown in the last two columns of Table 2 suggest that this limited willingness to commute has to do with money: unlike time, direct monetary expenses are not compensated. These columns show the percentage of workers who get either partial or full reimbursement for travel expenses. The proportion of workers receiving full reimbursement never exceeds 30 percent and short commutes of 1-30 minutes are relatively rarely compensated for. The proportion of workers receiving any reimbursement rises to 55 percent among those who commute 31-60 minutes and peaks at about 90 percent among those traveling 91-120 minutes.

TABLE 3 ABOUT HERE

Table 3 shows that reimbursement and wages are positively correlated. Keeping daily commuting time constant, hourly wages increase with the level of reimbursement. There are several possible explanations. First, firms might be interested in paying high wages because this guarantees a steady flow of applicants, and thereby decreases the opportunity costs associated with empty vacancies. The positive correlation implies that high wages are not sufficient to attract applicants from remote places, and additionally reimbursement must be paid. Another and more prosaic explanation focuses on tax evasion (see for example, Rouwendal and van Ommeren 2008). Reimbursement is not taxed, therefore both employers and workers are interested in receiving a part of the wage in the form of reimbursement. Since firms paying (and workers receiving) high wages gain more from tax evasion, the correlation between wages and reimbursement must be positive. It is also possible that respondents receiving any reimbursement reported a higher wage because they counted it as a part of wage. Unfortunately, the survey question did not make it clear to the respondents that they should not think of reimbursement when they estimate or tell their wages. Since it is impossible to assess these explanations, the relationship between wages and reimbursement remains obscure.

The next section is devoted to the question whether the positive correlation between commuting time and wages can be interpreted as a compensating wage differential.

4. REGRESSION ANALYSES

We proceed with the regression analysis of the relationship between wages and commuting time in order to estimate the net effect of commuting time. In the preceding section, we found that workers traveling more have higher wages. Moreover, the increase in wages seems to compensate for the value of time associated with commuting. This relationship, however, cannot be interpreted as a compensating wage differential. As mentioned earlier, a positive relationship between wages and commuting time is often explained in the urban economics literature in terms of selective residential choices: more able workers, having high salaries, prefer residences far from the CBD where all jobs are located. Additionally, most economists think it is human capital and the characteristics of the firm that determine wages. Our aim is to control for these characteristics and obtain an unbiased estimate of returns to commuting time.

Our assessment of compensating wage differentials is based on estimates from four regression models. We specify two regression equations, each of which being estimated using

two different methods. In all models, log hourly wage is regressed on commuting time. The first specification adds gender, education, age (and its square), type of occupation, firm size, type of industry, unemployment rate and year of job loss as control variables. The first specification thus intends to obtain an unbiased estimate of wage premium associated with total commuting costs. Note that commuting time is positively correlated with travel expenses, the commuting time variable in the context of the first specification reflects the effects of both time and money spent on commuting.

The second specification makes an attempt to separate the compensation paid for travel time from that paid for travel expenses. This is achieved by introducing three additional variables into the first specification: the product of partial reimbursement and commuting time, the product of full reimbursement and commuting time, and the product of urban residence and commuting time. The logic is as follows (Fujita 1989, Zax 1991). Receiving wage w_0 without commuting allows a consumption level of w_0/p where p is a composite measure of price level. The worker who spends time t on commuting has a consumption level of $(1-r)ct/p$, where c is the per unit monetary cost of commuting and r is the percent of travel costs reimbursed by the employer. Assuming that the well-being of the worker is the simple sum of consumption and leisure, the worker is unaffected by commuting if

$$\frac{w_0}{p} = \frac{\left[w_t - (1-r)\,ct\right]}{p} - t \quad ,$$

which yields

$$w_t - w_0 = ct - rct + pt \quad .$$

The first two interaction terms capture the percentage of travel expenses reimbursed. The third interaction term is a proxy of price level: average prices (including these of housing) are higher in towns than in villages.

Both specifications are estimated by two methods. We first estimate cross-sectional regressions using the pooled observations on previous and new jobs. Then we estimate the effect of changes in commuting time on changes in wages using fixed-effects regressions. The latter method is generally thought to give a better estimate of the returns to commuting (Manning 2003). Again, the issue is the elimination of the residential choice hypothesis. Although our sample does not include people who changed residential location, one might still argue that cross-sectional estimates of the returns to commuting are spurious rather than genuine causal effects. Wages are also determined by personality and abilities not captured by the control variables, and these unobserved traits had and effect on past wages. The residential choice hypotheses are about the effect of such traits or wages on residential choices. Therefore,

cross-sectional estimates might measure the joint effect of unobserved traits on wages and commuting distance. The fixed effect estimator keeps these unobserved traits constant.

TABLE 4 ABOUT HERE

The estimated returns to commuting time are presented in Table 4. (The underlying coefficients appear in the Appendix Table A2.) The unconditional effect is just the parameter estimate of commuting time in the first specification. The conditional effects are computed from the estimates of the second specification. The effect of commuting time conditional on receiving no reimbursement is just the coefficient of commuting time; the other conditional effects are the linear combinations of the coefficients of commuting time and that of the respective interaction terms. We also present the probabilities for the hypothesis that the estimates are equal to 0.1178. The reason is that, assuming eight hours working days, workers are fully compensated for travel time if the coefficient of commuting time corresponds to a 12.5 percent increase in hourly wages (Manning 2003).

The results do not lend much support to the hypothesis that workers are compensated for the time they spend on commuting. In the first specification (which does not include interaction effects) the coefficient of commuting time is positive, but it is not significant in the fixed effect regression. Both the cross-section and the panel estimates, however, are too small compared to our benchmark value so that we can reject the hypothesis that wages compensate for the time wasted on commuting. If we move to the conditional effects, we find negative estimates for the effect of commuting time among workers who do not receive any reimbursement for travel expenses. Not surprisingly, we can reject the hypothesis that they receive a compensating wage differential. The effect of commuting time among workers receiving some reimbursement is positive but still not large enough to accept the hypothesis that commuting time is compensated for. Finally, we find a larger positive effect among workers whose travel expenses are fully reimbursed. The fixed-effect estimate is large enough so that we cannot reject the hypothesis of compensating wage differential. To summarize, wages seem to compensate for travel time only if employers also compensate for monetary travel expenses. In other words, there are workers receiving no compensation for travel costs, and there are workers receiving compensation for both time and money wasted on travel.

The positive relationship between wages and commute is often interpreted in the literature in terms of compensating wages. he concept of compensating wages is related to the idea that firms in competitive labor markets decide to pay higher wages in order to hire and keep workers in otherwise bad jobs. The more often used search theoretic framework either assumes a wage

gradient or explains it using the idea of wage posting (Rouwendal 1998, Rogertson et al 2005): in order fill vacancies faster and to minimize the chances of job separations, employers are interested in increasing the wage they pay. In the remainder of this section, we make an attempt to explain our findings in terms of compensating wage differentials or strategic wage posting.

The application of compensating wage differentials or strategic wage posting requires an additional assumption about segmentation in labor markets. On the one hand, there are firms that easily find and keep workers. On the other hand, there are firms that find it difficult to hire and keep workers, and therefore they increase the wage they pay and even reimburse the travel expenses of the workers. The interpretation of our findings in terms of compensating wage differentials becomes more plausible if we can present some evidence on this segmentation.

The previous regression analyses were replicated in the subsample of workers who were employed in seasonal jobs (agriculture or construction). In these industries, the incentives to hire workers as quickly as possible are stronger than in other industries. The estimated effects of commuting time on wages are presented in Table 5. The striking result is that the conditional effect of commuting time among workers receiving full reimbursement disappears, at least in the fixed-effect regression, while it is present among those who receive either no or some reimbursement. Notice the large values of the estimates in the latter group: the conditional effects even exceed the benchmark value associated with a 12.5 percent increase in hourly wages. (And because the actual working day is probably more than eight hours in seasonal jobs, the benchmark value should be lowered to, say, 10 percent.). The large positive effect of commute on wages cannot be explained in terms of tax evasion or mental accounting of respondents because the effect is present among workers who receive no reimbursement. The positive effect, however, can be explained in terms of compensating wages: the job to be done is urgent and therefore workers are attracted by paying high wages. If the job is not urgent, then workers need some compensation for not working when the seasonal job is over.

TABLE 5 ABOUT HERE

5. CONCLUSIONS AND DISCUSSION

Although the unemployment rate shows a decreasing tendency in Hungary since 1994, it is still high in those villages where it was the highest (above 20 percent) in the mid 1990s. The purpose of this paper is to test the hypothesis that persistent unemployment in villages is due to the fact that commuting costs substantially exceed the returns to commuting in terms of wages (Köllő,

1997; Kertesi, 2000). More specifically, we examine two questions: (1) Do wages increase with commuting time? (2) Does commuting time have a positive effect of wages? In other words: do commuters receive a compensating wage premium for costly commuting? The latter question expresses the aim to eliminate the spurious correlation between commuting time and wages, due to selective residential choices.

Our questions are examined using data on registered unemployed who changed employer but at the same time did not move to other settlement. We first examined the distribution of commutes and the relationship between commuting time and wages. Hourly wages are positively correlated with commuting time. An hour increase in travel time is associated with a 11.6 percent increase in wages. Assuming eight hours working days, the coefficient indicates that wages compensate for the time wasted on commuting. However, monetary expensed do not seem to be compensated. The proportion of workers receiving full reimbursement never exceeds 30 percent. Since reimbursement and wages are positively correlated, workers who do not receive full reimbursement do not receive high wages. In the light of these data, it is not surprising that the vast majority, almost 80 percent of workers do not travel more than one hour.

Next, we estimated some regression models to obtain unbiased estimates of the returns to commuting. We estimated two different specifications, each of them using two different estimation methods. The results do not lend much support to the hypothesis that workers are compensated for the time they spend on commuting. In the first specification (which does not include interaction effects) the coefficient of commuting time is positive, but it is not significant in the fixed effect regression. Whatever estimation method is used, the small coefficients do not support the hypothesis that commuting time is fully compensated for. In the second specification, conditional effects were estimated. We find negative estimates for the effect of commuting time among workers who do not receive any reimbursement for travel expenses. Not surprisingly, we can reject the hypothesis that they receive a compensating wage differential. The effect of commuting time among workers receiving some reimbursement is positive but still not large enough to accept the hypothesis that commuting time is compensated for. Finally, we find a larger positive effect among workers whose travel expenses are fully reimbursed. To summarize, wages seem to compensate for travel time only if employers also compensate for monetary travel expenses. In other words, there are workers receiving no compensation for travel costs, and there are workers receiving compensation for both time and money wasted on travel.

Our research is an attempt to contribute to the explanation of persistent regional inequalities in Hungary. The consistent finding is that wages do not compensate for costly commuting with two exceptions: (1) Full reimbursement of travel expenses goes hand in hand with higher

wages; and (2) workers in seasonal jobs receive a compensating wage premium without receiving full reimbursement. To conclude, wages in regular (not seasonal) jobs do not seem to compensate for costly commuting. Our study therefore supports the conclusion of previous studies: commuting is too costly to induce people living in high unemployment regions to find a work in urban areas (Köllő, 1997, 2006; Kertesi, 2000).

Our findings might suggest that reimbursement of expenses on the part of employers is a necessary condition for the reduction of persistent regional inequalities. This conclusion, however, neglects the possibility that employers will reduce labor demand as a reaction to increases in labor costs. If employers cut labor demand, it is difficult to predict the net effect of reimbursement of expenses on regional differences in unemployment rates. Knowing the precise effect of reimbursement of expenses on labor demand is a necessary condition for formulating firm policy recommendations on the basis of our empirical results.

Our study has limitations because of the sample and the estimation method we used. A substantial limitation of our study is that our sample is probably not free of sample selection problems (Cooke and Ross 1999). Our sample stems from a survey of unemployed, and unsuccessful job searchers are not included in the sample. This might lead to the problem of self-selection if unobserved factors determining the success of job search (getting a job) are correlated with unobserved determinants of wages or commuting decisions. Another methodological problem is related to the second specification, which includes reimbursement of travel expenses, multiplied by commuting time, as explanatory variable. Models of wage posting suggest that reimbursement is endogenous. Firms are likely to determine wages before meeting employees; the reimbursement of travel expense is a decision which follows wage determination. Therefore, reimbursement and wages must be treated as dependent variables. The problem with this simulatenous equation approach is that reimbursement is not an interval but a categorical (ordinal) variable. An attempt was made to estimate a recursive path model but the maximum likelihood method failed to converge..

REFERENCES

Cooke, T. J. and S. L. Ross (1999): Sample selection bias in models of commuting time. *Urban Studies* 36: 1597-1611.

Fujita, M. (1989): *Urban Economic Theory*. University Press, Cambridge.

Hegedűs, J. 2004. The housing market and residential regional mobility in the 1990s. The case of Hungary. Pp. 73-80 in The Hungarian Labour Market. Review and Analysis. 2004., ed. by K. Fazekas, J. Koltay and Zs. Cseres-Gergely. Budapest, Institute of Econimics, HAS and Hungarian Employment Foundation.

Ihlanfeldt, K. R. and D. L. Sjoquist (1998): The spatial mismatch hypothesis: A review of recent studies and their implications for welfare reform. *Housing Policy Debate*, 9. 849–892.

Kain, J. (1992): The spatial mismatch hypothesis: three decades later. *Housing Policy Debate*, 3: 371-460.

Kertesi, G. (2000): Ingázás a falusi Magyarországon. Egy megoldatlan probléma. [Commuting in rural Hungary. An unresolved issue.] *Közgazdasági Szemle*, 47. 775–798.

Köllő, J. (1997): A napi ingázás feltételei és a helyi munkanélküliség Magyarországon: számítások and szampéldák. [Transport costs, availability and local unemployment in Hungary] *Esély*, Issue 2.

Köllő, J. (2002): Az ingázási költségek szerepe a regionális munkanélküliségi különbség fenntartásában. [Commuting costs and persistent regional differences in unemployment] *Budapesti Munkagazdaságtani Füzetek*, 2. sz. MTA Közgazdaságtudományi Kutatóközpont, Budapest.

Köllő, J. 2006. A napi ingázás feltételei és a helyi munkanélküliség Magyarországon. Újabb számítások és szampéldák [Transport costs, availability and local unemployment in Hungary. Some new results.] Budapest Working Papers on the Labour Market, 2006/1.

Leigh, J. P. (1986): Are compensating wages paid for time spent commuting? *Applied Economics*, 18: 1203-1213.

Rogertson, R, R. Shimer and R. Wright. 2005. Search-Theoretic Models of the Labor Market. A survey. Journal of Economic Literature, 43: 959-988.

Rouwendal, J. 1998. Search theory, spatial labor markets, and commuting. Journal of Urban Economics, 43: 1-22.

Rouwendal, J and J. van Ommeren. 2008. Recruitment in a monopsonistic labour market. Will travel costs be reimbursed? Tinbergen Institute Discussion Paper, TI 2007-044/3

Rouwendal, J. and P. Rietveld, 1994. Changes in commuting distances of Dutch households. Urban Studies, 31, 1545-1557.

Van Ommeren, J. 1996. Commuting and relocation of jobs and residences. A search perspective. PhD dissertation, Vrije Universiteit Amsterdam.

van der Vlist, A. 2001. Residential mobility and commuting. PhD dissertation, Vrije Universiteit Amsterdam.

Zax, J. S. 1991. Compensation for commutes in labor and housing markets. Journal of Urban Economics 30, 192-207.

TABLE 1
Means of the variables used in subsequent analyses (N=2069)

	mean	sd
hourly wage	240.3	88.396
Reimbursement of travel expenses		
- partial	0.365	0.482
- full	0.098	0.298
commuting time (hours)	0.950	0.638
male	0.532	0.499
Education: A-level	0.228	0.419
Age (in 2000)	34.400	10.050
(Age-40) squared	132.1	127.394
white-collar job	0.135	0.342
Firm size:		
- 5-50 employees	0.405	0.491
- 51- employees	0.492	0.500
Job in seasonal industry	0.145	0.352
Unemployment rate at place of work	0.087	0.053
Previous job lost in 2001	0.412	0.492

TABLE 2
Number of observations and average hourly wages and
the distribution of workers receiving reimbursement by commuting time

Daily commuting time	N	%	Hourly wage (HUF)	Percentage of workers receiving partial reim-bursement	full reim-bursement
1-30 minutes	868	42.0	222.7	15.0	3.8
31-60 minutes	737	35.6	243.9	43.4	12.1
61-90 minutes	177	8.6	254.5	66.7	7.3
91-120 minutes	197	9.5	269.1	70.1	20.8
121-180 minutes	90	4.3	288.9	55.6	30.0

TABLE 3
Average hourly wages by commuting time and level of reimbursement

Daily commuting time	No reimburse-ment	Partial reimburse-ment	Full reimburse-ment
1-30 minutes	217.7	240.0	259.8
31-60 minutes	232.9	246.0	277.1
61-90 minutes	233.5	258.6	290.8
91-120 minutes	238.3	268.4	284.9
121-180 minutes	261.2	281.2	316.6

TABLE 4

Estimated net effect of commuting time on log hourly wages and results for the test of the hypothesis that the net effect corresponds to a 12.5 percent increase in hourly wages

Definition of the effect	Pooled OLS estimator		Fixed-effects estimator	
	Estimate	p value	Estimate	p value
Unconditional	0.0501	0.0000	0.0304	0.0009
Conditional on				
- no reimbursement	-0.0251	0.0000	-0.0754	0.0000
- partial reimbursement	0.0356	0.0000	0.0325	0.0188
- full reimbursement	0.0708	0.0101	0.0705	0.2460

TABLE 5

Estimated net effect of commuting time on log hourly wages and results for the test of the hypothesis that the net effect corresponds to a 12.5 percent increase in hourly wages. Workers of seasonal industries only

Definition of the effect	Pooled OLS estimator		Fixed-effects estimator	
	Estimate	P value	Estimate	P value
Unconditional	0.0602	0.1136	-0.0238	0.0317
Conditional on				
- no reimbursement	0.0852	0.6997	0.3926	0.2527
- partial reimbursement	0.0741	0.3304	0.3017	0.2187
- full reimbursement	0.0717	0.3002	-0.0978	0.0070

APPENDIX TABLE A1
Definition of variables

Variable	Definition and Notes
Hourly wage	Gross monthly salary, as reported by the respondent, divided by 200
Commuting time	Time spent on travel to work and back on an average day
Partial reimbursement	1 if the employer reimburses some part of travel expenses; 0 otherwise
Full reimbursement	1 if the employer organizes travel or pays for the travel expenses; 0 otherwise
Male	1 if male; 0 if female
Education	1 if the respondent has A-level; 0 if the respondent has less education
Age	Age at the time of interview - 18
Age-squared	$(\text{Age at the time of interview} - 40)^2$
Type of occupation	1 if the respondent has a white-collar job 0 if the respondent works in a manual occupation
Firm size	Number of employees in the firm measured with three categories (1-5 employees, 5-50 employees, and 50< employees)
Seasonal industry	1 if the job is in construction or agriculture; 0 otherwise
Unemployment rate	Unemployment rate in the location of the firm
Year of job loss	1 if the last job was lost in 2001 0 if the last job was lost in 2000

APPENDIX TABLE A2
Parameter estimates of regressions of log hourly wages

	Pooled OLS estimator		Fixed-effects estimator	
Commuting time (hours)	0.050**	-0.025	0.030	-0.075
	(4.024)	(-1.064)	(1.153)	(-1.619)
Product of commuting time and				
- partial reimbursement		0.061**		0.108**
		(3.397)		(3.658)
- full reimbursement		0.096**		0.146**
		(4.359)		(3.360)
- urban residence		0.017		-0.026
		(1.204)		(-0.546)
male	0.165**	0.165**		
	(10.314)	(10.361)		
Education: A-level	0.094**	0.094**		
	(4.165)	(4.177)		
Age (in 2000)	0.001	0.001		
	(1.217)	(1.415)		
(Age-40) squared	-0.000	-0.000		
	(-0.613)	(-0.501)		
white-collar job	0.089**	0.090**	-0.025	-0.021
	(3.152)	(3.224)	(-0.347)	(-0.290)
Firm size: 5-50 employees	0.102**	0.100**	0.080	0.079
	(4.158)	(4.078)	(1.636)	(1.644)
Firm size: 51- employees	0.310**	0.297**	0.195**	0.186**
	(13.119)	(12.587)	(4.110)	(3.889)
Job in seasonal industry	-0.068**	-0.076**	-0.055	-0.058
	(-2.734)	(-3.082)	(-1.270)	(-1.387)
Unemployment rate at place of work	-0.624**	-0.612**	-1.123**	-0.922*
	(-3.717)	(-3.655)	(-3.085)	(-2.540)
Previous job lost in 2001	0.098**	0.096**		
	(6.387)	(6.296)		
Constant	5.037**	5.059**	5.365**	5.396**
	(93.825)	(94.288)	(91.061)	(93.323)
R-squared	0.215	0.222	0.068	0.090
F-test	58.73	48.71	8.944	7.694

Notes: Numbers in parentheses are t statistics; estimates of underlying standard errors are adjusted for clustering on individuals. Number of observations = 2069; Number of individuals = 1488.
* significant at 5%; ** significant at 1%.