

Commuting and life satisfaction in Germany

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1 Introduction

People spend a considerable amount of their time commuting to and from work. Commuting has become an important aspect of our lives that demands a lot of our valuable time. In Germany in 2000, average daily commuting time was 42 minutes.¹ According to the German Microcensus 2000, 16 % of respondents accomplish a commuting distance of 25 kilometers or more for one way and 31 % travel from 10 up to 25 kilometers from home to work.² For most people, commuting is a mental and physical burden. In contrast, from an economic perspective commuting is just one of numerous decisions rational individuals make. People have to decide between more attractive work (higher salary and/or better work environment) coupled with longer or more arduous commuting or less attractive work coupled with less commuting. If commuting has extra psychological costs, then traveling longer distances to and from work is only chosen if it is either compensated by an intrinsically or financially rewarding job or by additional welfare gained from a pleasant living environment. Accordingly, commuting is determined by an equilibrium state of the housing and labor market, in which individuals' well-being or utility is equalized over all combinations of alternatives in these two markets. This view reflects the strong belief in economics that market forces lead to an equilibrium in which individuals find themselves in their utility maximizing position, given their opportunities.

This strong notion of equilibrium in urban and regional economic theory, as well as in public economic theory, has only been partially tested so far. Studies have not been carried out as to whether people find themselves in their utility maximum: rather, derived hypotheses within the equilibrium framework have been analyzed. There is indeed considerable evidence for capitalization of transportation infrastructure in the price of land and for compensating wage differentials due to commuting distance. However, these findings do not require an equilibrium

situation, but can also be explained by the law of marginal substitution. Therefore a direct test is necessary.

In this paper, we use data on subjective well-being as proxy measures for people's utility in order to directly test the strong notion of equilibrium in location theory. High quality data are available for Germany, collected by the German Socio-Economic Panel. In a data set spanning 14 years, we study whether commuters are indeed compensated for the stress incurred, as suggested in economic models.

Our main result indicates, however, that people with long journeys to and from work are systematically worse off and report significantly lower life satisfaction. This result on commuting is paradoxical from the standard economic point of view.

The paper proceeds as follows. Section 2 summarizes the costs and benefits of commuting as discussed in economics and psychology. In section 3, the data set is described and the empirical analyses are conducted. Results for several explanations of the commuting phenomenon are reported in section 4. Section 5 briefly discusses the results in the light of economics and psychology. Concluding remarks are offered in section 6.

2 The Costs and benefits of commuting

The burden of commuting

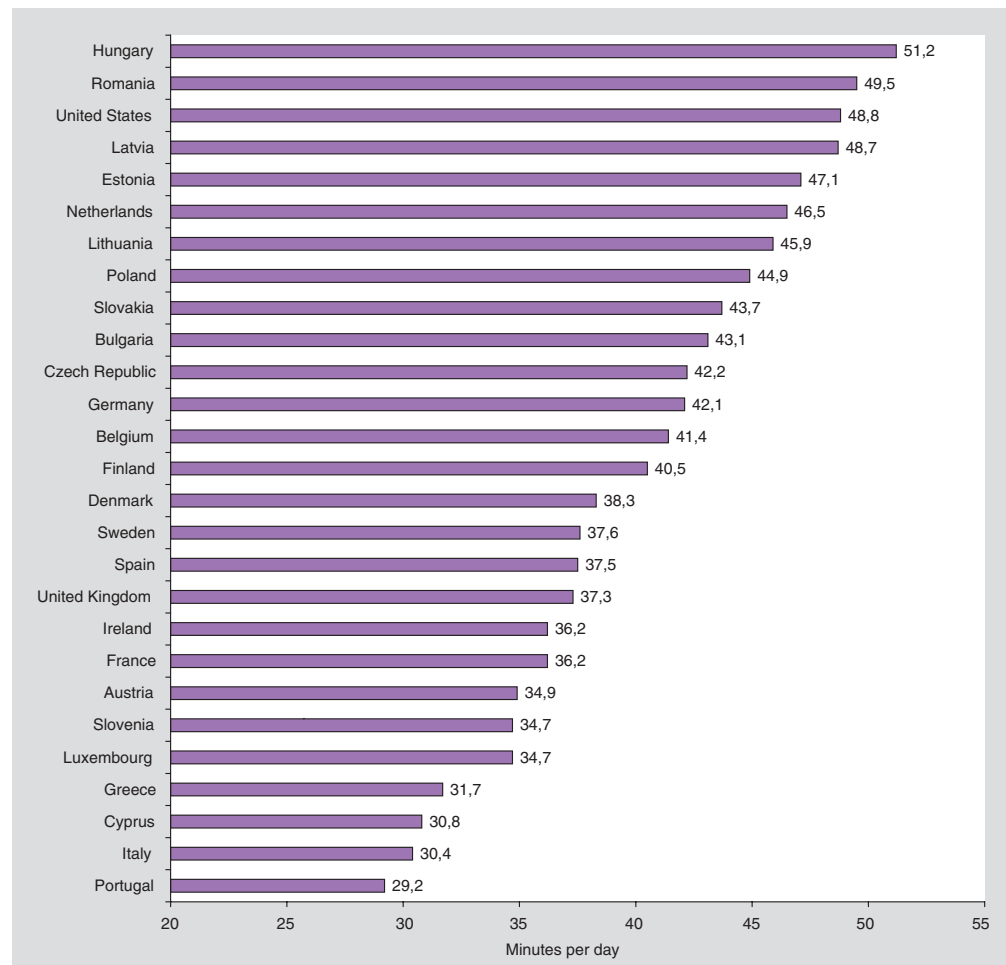
Commuting involves much more than just covering the distance between home and work. Commuting takes time, but also generates out of pocket costs, causes stress and intervenes in the relationship between work and family. In fact, it seems that commuting is that daily activity that generates the lowest level of positive affect, as well as a relatively high level of negative affect.³ Moreover, commuting is salient in the every-day routines of many people's lives. Figure 1 gives a brief overview about commuting in European countries and the United States. It clearly shows that commuting is a widespread phenomenon.

People with long journeys to and from work are systematically worse off and report significantly lower life satisfaction.

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Figure 1
Average daily commuting
time in Europe and the U.S.



Sources: Data for European countries is from the European Survey on working conditions, conducted by the European Foundation for the Improvement of Living and Working Conditions in 2000 for member countries and in 2001/02 for acceding and candidate countries. Data for the U.S. is from U.S. Census Bureau: 2002 American Community Survey

(1)
Data is from the European Survey on working conditions, conducted by the European Foundation for the Improvement of Living and Working Conditions in 2000.

(2)
For a detailed description of commuting in Germany, see Kloas/Kuhfeld 2003.

(3)
Kahneman et al. 2004

(4)
For a review, see Koslowsky et al. 1995, see also Davidov et al. 2002 for a study on commuting in Germany

(5)
EPA 2001

(6)
e.g. Marzotto et al. 2000

(7)
Small 1992, p. 44

(8)
For surveys, see e.g. Haefner et al. 2001, Koslowsky 1998, Koslowsky et al. 1995, Novaco et al. 1990

Workers in these countries commute between 29.2 minutes in Portugal and 51.2 minutes a day in Hungary. The average daily commuting time in the former EU15 is 37.5 minutes. In Germany, traveling to work takes, on average, 42.1 minutes.

Engineers and social scientists have studied a wide range of the private and social costs of commuting.⁴ For example, it has been calculated for the United States that a “typical household spends nearly 20 percent of its income on driving costs – more than it spends on food”.⁵ Besides these private costs, there are the social costs of commuting, due to congestion and pollution of the environment.⁶ The calculation of the costs of congestion focuses on the value of time when delays occur whilst traveling. In an extensive survey, Kenneth A. Small concludes that “a reasonable average value of time for the journey to work is 50 percent of the gross wage rate, while recognizing that it varies among different industrialized cities from perhaps 20 to 100 percent of

the gross wage rate, and among population subgroups by even more.”⁷

Psychologists have focused on the non-pecuniary costs of commuting and emphasize that it is an unpleasant experience that often has delayed effects on health and family life.⁸ Commuting is associated with many environmental stressors like noise, crowds, pollution and thermal conditions that cause negative emotional and physical reactions. Reactions depend, of course, not only on the time and distance involved in commuting, but also on other factors that interact with the stressors mentioned above. Commuting is more stressful when people are not in control of certain factors that can crop up during the drive to work, e.g. due to traffic congestion or when they are under considerable time pressure. The strain of commuting is associated with raised blood pressure, musculoskeletal disorders, lowered frustration tolerance and increased anxiety and hostility, being in a bad mood when arriving at work in the morning and

coming home in the evening, increased lateness, absenteeism and turnover at work, as well as adverse effects on cognitive performance.⁹ The German commuters studied in the empirical analysis below also confirm that commuting is stressful over and above the monetary costs involved. In the sample of people who commute more than 30 minutes, 19 % indicate that commuting is a big mental and physical burden, 50% indicate that it is a small burden and only 31 % indicate that it is not mentally and physically stressful.

The Benefits of Commuting

An effective transportation system increases factor productivity, because it facilitates the allocation of factors to their most valuable use. This benefit is studied at the macro level. At the individual level, people benefit when they commute to an office or a factory to supply their work, or when they can find reasonable housing further away from their job. Individuals take these benefits, as well as the pecuniary and non-pecuniary commuting costs mentioned above, into consideration when they make decisions on where to live, where to work and how to commute. Accordingly, houses that are further away from the location of work opportunities are less attractive to people, and thus have a lower market value, *ceteris paribus*. Jobs that involve a longer commute have to pay employees more in order to attract them and keep them. If all the participants in a perfect housing and labor market optimize, all the commuters are fully compensated for their traveling costs from home to work, either by higher wages or by lower rents. Individuals' utility is (in equilibrium) equalized over all possible locations within space. These insights have been established in classical urban location theory¹⁰ and public economic theory based on Charles M. Tiebout's¹¹ model of fiscal competition between jurisdictions.¹² They reflect the strong belief in economics that market forces lead to an equilibrium in which rents and discrimination are prevented.

The strong notion of equilibrium in location theory has only been partially tested so far. It has not been studied whether there are systematic rents: rather, derived hypotheses within the equilibrium framework have been analyzed. There is considerable

evidence for capitalization of transportation infrastructure in the price of land, and distance from job locations and other amenities in housing prices¹³, as well as for compensating wage differentials due to commuting distance.¹⁴ For Germany, Knut Gerlach and Gesine Stephan find, based on data from the German Socio-economic Panel, that longer commuting times have a positive impact on wages, especially for married women.¹⁵

However, these approaches do not allow us to assess whether the compensation of commuters is complete and, if it is not, to calculate the amount that would be needed. The extent of compensation would provide evidence to judge the relevance of conclusions that are based on equilibrium theories. In the next section, we propose a new approach of directly measuring the degree to which commuters are compensated for the burden of commuting.

3 Effects of commuting on subjective well-being

The Data

Individuals' compensation for commuting has so far been studied in terms of higher earnings and lower rents for housing. Here we apply a novel approach and directly analyze commuters' level of utility. Thereby, reported subjective well-being is used as a proxy measure for utility. Subjective well-being is the scientific term in psychology for an individual's evaluation of his or her experienced positive and negative affect, happiness or satisfaction with life. With the help of a single question or several questions on global self-reports, it is possible to get indications of individuals' evaluation of their life satisfaction or happiness.¹⁶ Behind the score indicated by a person lies a cognitive assessment as to the extent their overall quality of life is judged in a favorable way.¹⁷ Although using subjective well-being as a proxy for utility is not (yet) standard practice in economics, indicators of happiness or subjective well-being have increasingly been studied and successfully applied.¹⁸

- (9) Koslowsky et al. 1995
- (10) See Alonso 1964, Mills 1972, Moses 1962, Muth 1969 and Huriot/Thisse 2000 for recent developments
- (11) Tiebout 1956
- (12) e.g. Conley/Konishi 2002
- (13) e.g. McMillen/Singell 1992, So et al. 2001
- (14) e.g. van Ommeren et al. 2000, Zax 1991
- (15) Gerlach and Stephan 1992
- (16) Diener et al. 1999, Kahneman et al. 1999
- (17) Veenhoven 1993
- (18) e.g. Clark/Oswald 1994, Di Tella et al. 2001, Easterlin 2001, Frey/Stutzer 2000, Kahneman et al. 1997, and for surveys see Frey/Stutzer 2002a,b, 2005 and Layard 2005

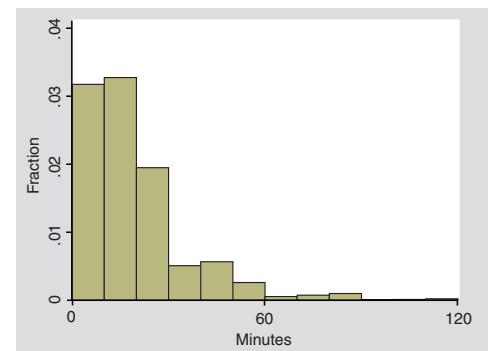
Measures of reported subjective well-being passed a series of validation tests, revealing that people reporting high subjective well-being are more often smiling during social interactions and are less likely to commit suicide. Changes in brain activity and heart rate account for substantial variance in reported negative affects. Reliability studies found that reported subjective well-being is fairly stable and sensitive to changing life circumstances.¹⁹ However, in order to conduct welfare comparisons on the basis of reported subjective well-being, further conditions have to be met. Well-being must be cardinal and interpersonally comparable. Economists are likely to be sceptical about both claims. However, evidence has been gathered that both of them may be less of a problem on a practical level than on a theoretical level.²⁰ Happy people, for example, are rated as happy by friends and family members²¹, as well as by spouses. Furthermore, ordinal and cardinal treatments of satisfaction scores generate quantitatively very similar results in micro-econometric happiness functions.²² The existing state of research suggests that, for many purposes, happiness or reported subjective well-being is a satisfactory empirical approximation to individual utility.

The current study is based on data on subjective well-being from the German Socio-Economic Panel Study (GSOEP). The GSOEP is one of the most valuable data sets for studying individual well-being over time. It was started in 1984 as a longitudinal survey of private households and persons in the Federal Republic of Germany, and was extended to include residents in the former German Democratic Republic in 1990. From this survey, we use the seven waves between 1985 and 1998 that contain information about individual commuting time. Observations for the seven waves are from all the samples available (samples A to F). People in the survey are asked a wide range of questions with regard to their socio-economic status and their demographic characteristics. Moreover, they report their actual commuting time and their subjective well-being. Commuting time is captured by the question "How long does it normally take you to go all the way from your home to your place of work using the most direct route (one way only)?" Reported subjective well-being is based on the question "How

satisfied are you with your life, all things considered?" Responses range on a scale from 0 "completely dissatisfied" to 10 "completely satisfied". In order to study the effect of commuting on individual well-being, we restrict the sample to those who are actually commuting and who either report being employed or self-employed.

Figure 2 presents the distribution of reported commuting time in Germany between 1985 and 1998. On average, people in the sample commute 23 minutes one way (a total of 46 minutes a day) with a standard deviation of 19 minutes. Median commuting time is 20 minutes. Commuters, who report traveling to work taking an hour or more, comprise 5.4 percent of the sample.

Figure 2
Average daily commuting time (one way)



Source: Stutzer and Frey (2004b) based on GSOEP

Commuting and Reported Satisfaction with Life

The concept of equilibrium in economics predicts that pecuniary, as well as mental, costs of commuting are compensated for on the labor and housing market. Thus, individuals' utility level is equalized over all actual combinations of alternatives in these two markets. This, of course, only holds for homogeneous people. We start with this assumption to introduce our empirical testing strategy. We will, however, extend our argument to include people with heterogeneous preferences. In the underlying model, commuters' utility is increasing in the consumption of goods, services and housing, and decreasing in the disamenity of commuting time.

According to the basic idea of compensation, utility is equal for observed combinations of income, time spent commuting, and housing rents across individuals. In the

(19) See Frey/Stutzer 2002b for references

(20) e.g. Kahneman 1999

(21) e.g. Lepper 1998

(22) See, e.g., Frey/Stutzer 2000, Ferrer-i-Carbonell/Frijters 2004

simple model, this result is due to three effects of an increase in commuting time:

- There is a marginal gain in utility due to a higher level of consumption that is reached because jobs that require longer commutes offer a higher income.
- Longer commuting time reduces rents for housing and thus leaves additional money for consumption.
- Utility marginally decreases due to the burden of spending more time commuting.

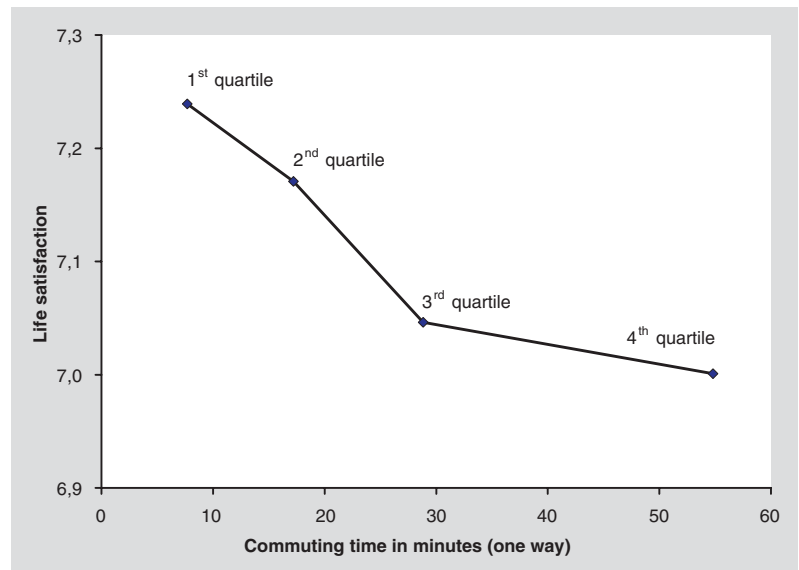
Given that incomes and rents for housing exclusively reflect compensation for commuting conditions, the three effects add up to zero.

The overall prediction that there is no correlation between commuting time and utility due to compensation can be tested directly. Commuters' reported satisfaction with life is taken as a proxy measure for individual utility. Under the null hypothesis, commuting time is entirely compensated by either higher salaries or lower rents for housing so that there is no statistical correlation between commuting time and life satisfaction. The alternative hypothesis states that commuting time is not fully compensated on the labor and housing market.

Figure 3 provides a first visual test to see whether there are indications of any kind of a correlation between commuting time and people's life satisfaction. Average life satisfaction is reported for the four quartiles of commuting time. Contrary to the prediction of the null hypothesis, results indicate that there is a sizeable negative correlation between commuting time and individuals' well-being. For each subsequent quartile of longer commuting time, there is, on average, a lower reported satisfaction with life. While life satisfaction is 7.24 points, on average, for people who commute 10 minutes or less (1st quartile), average satisfaction scores for the top 4th quartile (commuting time more than 30 minutes) is 7.00 points, i.e. 0.24 points lower.

The raw correlation between commuting time and life satisfaction does not take into consideration that we compare people with heterogeneous preferences facing different restrictions. In other words, the optimal commuting time is probably systematically

Figure 3
Commuting time and average reported satisfaction with life, Germany 1985–1998



Source: Stutzer and Frey (2004b) based on GSOEP

different for different groups of people. Thus the observed lower subjective well-being of people who spend more time traveling from home to work might just reflect that these are people with different socio-demographic and socio-economic characteristics. In order to apply the test for compensation, groups of people who are very similar have to be empirically constructed. Technically, a multiple regression approach is applied to control for individual characteristics.

Heterogeneous preferences for commuting also imply sorting. It is the quintessence of spatial economics that people reside where their preferences are best met. It is this process of sorting and arbitrage that leads to the prediction on compensation. How do heterogeneous tastes for commuting and sorting affect any observed partial correlation between commuting time and life satisfaction in a cross-section estimation?

Imagine that people have homogenous tastes in all respects but commuting. There are some people who strongly dislike commuting. For a given income generating potential, they are worse off than people who do not mind commuting and they therefore experience lower utility. Where do people live who dislike commuting? They have a high willingness to pay for a short commute. Other things equal, they thus live closer to where they work and are willing to pay more for housing. From

(23)
For a more detailed presentation see Stutzer/Frey 2004b

(24)
It is important to note that the regression neither includes respondents' labor income nor their household income. This is crucial, because income is one of the variables through which people are compensated for the distance they cover to and from work. Our approach only makes a sharp prediction of no correlation if all channels for compensation remain uncontrolled. If income is controlled, people who spend more time commuting are, of course, worse off, *ceteris paribus*. – A discussion of the results for the socio-demographic and socio-economic factors in Germany can be found in Stutzer and Frey 2004.

(25)
Ibid., table 4

the two arguments, the following picture emerges: People who dislike commuting have a disadvantage in our spatial economy. While they choose a combination of job and housing that involves relatively short commuting, they experience lower utility than people whose disutility from commuting is small. Accordingly, all other things being equal, a positive correlation between commuting time and a proxy measure for utility is expected. The effect of heterogeneous preferences for commuting and sorting thus runs counter to the correlation observed in our sample. With regard to the sorting argument, we estimate a lower bound in the following cross-section equation.

The results of the econometric estimates in table 1²³ show that people who spend more time to commuting report lower satisfaction with life, *ceteris paribus*. The effect is statistically highly significant and corroborates the findings in figure 3. An

increase of an individual's commuting time from a level of 0 to 19 minutes (i.e. by one standard deviation) refers, on average, to a 0.12 point lower subjective well-being.²⁴

The finding for commuting is again at odds with the prediction of location theory and the implicit assumption in many economic models that, on average, people are compensated for commuting. The size of the commuting effect is half the difference in the subjective well-being of singles with and without a partner, or equal to the effect of finding or losing a partner for those being single. Compared to the effect of becoming unemployed (= -0.671)²⁵, an increase in commuting time by one standard deviation is about one fifth as bad for life satisfaction.

We also estimated a regression with individual fixed effects, which excludes spurious correlation due to time-invariant unobserved characteristics of people. Partial correlations again show a negative effect of commuting time on life satisfaction. People who spend 19 minutes rather than 0 minutes commuting (one way, i.e. one standard deviation) report, on average, a -0.064 point lower utility level. Thus, the results of the raw correlation and the pooled estimation are confirmed.

To our knowledge, our empirical analysis for the first time directly tests the strong notion of equilibrium in location theory. This is made possible by applying individual reported subjective well-being as a proxy measure for utility. Contrary to the common understanding in economics, there seems to be a systematically incomplete compensation of people who choose to spend more time commuting between home and work.

How far short of full compensation does the equilibrium prediction fall for people in the data set? In other words, how much additional income would a commuter have to earn in order to be as well off as somebody who does not commute? For this analysis, a life satisfaction function is estimated which also includes the respondent's labor and household income, as well as working hours. Full compensation for commuting 23 minutes (one way), i.e. the sample mean, compared with no commuting at all, is estimated to require an additional monthly income of approximately 242 Euros or 18.86 percent of the average monthly wage.²⁶

Table 1
Commuting and satisfaction with life, Germany 1985–1998
Dependent variable: satisfaction with life (0–10)

	Coefficient	t-value
Commuting time (in minutes)	-0.0070	-7.27
Commuting time ²	0.030e-3	4.11
Age	-0.052	-7.10
Age ²	0.560e-3	6.32
Male		Reference group
Female	-0.040	-1.93
Years of education, ln	0.446	8.32
No children		Reference group
Children	-0.054	-1.72
Single, no partner		Reference group
Single, with partner	0.252	4.49
Married	0.373	7.94
Separated, with partner	0.259	1.36
Separated, no partner	-0.388	-4.03
Divorced, with partner	0.332	3.97
Divorced, no partner	-0.286	-4.22
Widowed, with partner	0.409	2.22
Widowed, no partner	-0.206	-1.99
Spouse living abroad	-0.842	-4.48
No. of household members ^{1/2}	-0.030	-0.69
Employed		Reference group
Self-employed	-0.235	-3.44
Western Germany		Reference group
Eastern Germany	-0.715	-25.35
Constant	7.278	129.82
Number of observations	27015	

Notes: Pooled least squares regression. Additional control variables not shown are "child of the head of household", "not child of the head of household", "EU foreigner", "other foreigner" and year dummies.

Source: Stutzer and Frey (2004b) based on GSOEP

4 How to explain the commuting paradox?

The finding that people who spend more time commuting are systematically worse off stands in sharp contrast to the equilibrium view in economics. There are two completely different ways of reacting to this challenge: First, the empirical finding may be misleading. In fact, equilibrium is maintained when households are considered as units that are compensated, or when utility from jobs and housing are studied directly. Second, equilibrium may not be attained because of frictions. Transaction costs restrict residential and job mobility and prevent commuters from being fully compensated.

4.1 Misleading empirical findings

Is full compensation attained at the household level?

While commuting might be a burden for those involved, the members of the family of those persons might benefit so that, overall, the households' well-being is equalized.²⁷ The empirical finding can thus be explained by a too limited selection of the decision making unit. At a household level, the equilibrium may still be attained.

This possible explanation of the commuting paradox can be empirically studied. We analyze whether an individual's subjective well-being is increasing in relation to his or her partner's commuting time. A positive partial correlation could balance out the compensation missing for the people who are actually commuting. However, results show exactly the opposite: the more time respondents' partners spend commuting, the less satisfied the respondents are. This result indicates that commuting might even result in negative externalities for other family members (consistent with previous research on commuting and family tensions mentioned in the first part of section 2). Very similar effects are estimated if the respondent's own commuting time is taken into account, as well as if the sample is restricted to two person households. In the latter case, there are no children who can potentially benefit from certain family members' commuting. There is thus no evidence that people systematically benefit from the commuting of other household members.

Is there compensation in satisfaction in particular life domains?

There is a second reason why equilibrium could actually be attained, though not be reflected accordingly in reported subjective well-being. When people make a judgment about their well-being, particular life domains and experiences might be more salient than others.²⁸ In our case, commuting might be over-represented in people's evaluation calculus at the time of the interview.

In order to detect possible compensation on the labor and the housing market that might not be accurately measured in overall life satisfaction, domain satisfaction is studied additionally. According to the initial notion of equilibrium, it is hypothesized that people spending more time commuting are compensated by a more attractive job or home and, accordingly, report higher satisfaction with these two aspects. However, results for domain satisfaction contradict these predictions. People with a lengthy distance to and from work do not report increased satisfaction with their dwelling and report even lower satisfaction with their job. Employed and self-employed people who spend an hour commuting (one way) report, on average, a 0.15 points lower satisfaction with their job. Both findings are inconsistent with the idea of compensation in location theory and sustain the commuting paradox. The results further indicate that commuting time is significantly negatively correlated with health satisfaction and satisfaction with the environment (another potential domain for compensation) and it has a large negative effect on people's satisfaction with their spare time.

4.2 Do frictions prevent equilibrium?

The concept of equilibrium is fundamental to economics.²⁹ In the context of mobility, an equilibrium view is underlying modern neoclassical urban location theory, as well as public economic theory.³⁰

There are, however, disequilibrium models (or search models) in urban and regional economics that complement Alonso-Muth type residential location models.³¹ These models take transaction costs explicitly into account.³² While they generate similar

(26) Full compensation for commuting one hour (one way), compared with no commuting, is estimated to require an additional monthly income of approximately 515 Euro or 40 percent of the average monthly wage.

(27) Becker 1981

(28) Schwarz/Strack 1999

(29) e.g. Becker 1976

(30) Economists may, however, be inventive enough to find reasons why equilibrium is not attained. But if this path is followed, the equilibrium loses its power to explain empirically observed phenomena.

(31) For a survey see e.g. Clark/van Lierop 1986, Crampton 1999

(32) e.g. Weinberg et al. 1981, van Ommeren et al. 1997

predictions for individual behavior on the urban labor and housing market to the former ones, they predict lower utility for those in a disadvantaged situation with long commuting times.³³

Can the commuting phenomenon observed be explained by transaction costs? Transaction costs prevent people from adjusting to economic shocks. In particular, transaction costs might hinder people experiencing a longer or more disturbing commuting time ex post than expected ex ante from re-optimizing. Therefore people might be locked into a disadvantaged commuting situation.

The issue of frictions is empirically approached looking at institutional conditions and particular groups of people who are potentially forced to spend more time commuting, for which they are not compensated. There is, e.g., an extensive literature on the consequences of residential race segregation in cities for earnings and employment differences according to race.³⁴ Three alternative hypotheses are put forward. They address the issue of segregation according to income classes, transaction costs for owners of houses and the role of specific life events on commuting.

The first institutional explanation refers to *differences in social class*. It is hypothesized that discrimination and segregation in Germany leads to the negative correlation between commuting time and people's well-being. This hypothesis captures the notion that poor people have less chance of optimizing, due to powerful actors on the housing and labor market, so that they end up spending more time commuting that is not compensated.³⁵ Separate estimations are estimated for the effect of commuting time on satisfaction with life for people who live in a household with below and above median equivalence income. Contrary to the first institutional explanation, there is no statistically significant difference in the negative effects of commuting on life satisfaction for the two groups.

The second explanation is based on *institutional restrictions on the housing market*. It can be argued that people's choice between renting and owning property is partly determined by inheritance and other reasons for path dependence. Given the high transaction costs for the transfer of property rights, owners might then be locked in a suboptimal commuting situation. While a smaller negative effect of commuting on the well-being of renters is estimated than of house owners, the former effect is not statistically significantly smaller.

A third explanation refers to *specific events in people's lives* that could explain the paradoxical finding. People are restricted in their choice and possibilities of optimizing commuting time when they experience drastic life changes, like getting divorced or becoming unemployed. People who get re-employed after a period of unemployment may start with a less attractive job, including a long journey from home to work. Couples who split up may leave one or both partners in housing conditions with increased commuting time. In these scenarios, "third" variables like re-employment, or couples separating, affect commuting time and life satisfaction simultaneously and cause spurious correlation.³⁶ Separate regressions are run for a sample that includes people who have experienced drastic life changes (either they were made redundant or got divorced during the time span in the sample) and a sample of people who have not experienced such changes. According to the stated argument, it is hypothesized that negative effects of commuting are mainly observed for people leading turbulent lives, and that other people only choose to commute when they are compensated. However, the hypothesis is not supported. There is not only a large negative effect for people who either experienced divorce or unemployment, or both, but also for people who did not make these experiences.

All three potential explanations for the empirical phenomenon that study some sort of restrictions to optimization, and thus specify possible transaction costs, fail to explain the commuting paradox.

(33)
e.g. van Ommeren 2000

(34)
e.g. Crampton 1999, Gobillon et al. 2003

(35)
The correlation between income and commuting time is empirically studied, and it turns out that the hypothesis is not supported. There are only small differences in the commuting time of people from rich and poor households, but richer people tend to commute more. A household with an equivalence income that is 1,500 Euro above the mean commutes about 1 minute longer from home to work on average than a household with mean income.

(36)
However, already our baseline estimate controls for many individual characteristics, e.g. people's marital status, and exclude many explanations based on omitted variables that capture to what extent people commute voluntarily.

5 Behavioral explanations

It may be argued that individuals' decisions concerning commuting cannot be fully understood within the traditional economic framework. It is an issue "(w)here economics stops short"³⁷. Inspiration from other social sciences has to complement an economic analysis of commuting behavior. Most prominent are insights from psychology that have been successfully integrated into what is called economics and psychology.³⁸

There are at least two lines of reasoning that could contribute to a better understanding of people's commuting behavior:

- *Incorrect cost assessment*

People might not be capable of correctly assessing the true costs of commuting for their well-being. They might rely on inadequate intuitive theories when they predict how they are affected by commuting. In particular, they may make mistakes when they predict their adaptation to daily commuting stress.³⁹ It has, for example, been found that people do not get used to random noise.⁴⁰ In contrast, people adapt to a large extent to higher income.⁴¹ In the case of overestimated adaptation, people systematically choose too long commuting times. A similar reasoning is followed in Uri Simonsohn.⁴² He argues that commuting behavior can be better understood in a framework of constructed preferences. People come up with some reference level of commuting time or commuting radius that they are only prepared to give up after experiencing negative effects on their well-being. In a challenging study on people moving from one US city to another, Simonsohn finds that people coming from a city where the average commuting time of the population is high (or low) also choose to commute more (or less) than average at their new place of residence (keeping individuals' own past commuting experience constant). In the latter model, people can thus either commute too much or too little.

- *Weakness of will*

People's insufficient will-power might be another reason why long commutes are not compensated.⁴³ People have limited self-control and insufficient energy, inducing some people to not even try to improve their lot. This view corresponds to what some lay people seem to think. The decision to start searching for a job closer to home or an apartment that reduces commuting time is again and again postponed to the following week. Thus, some people might not only smoke more and save less than they would actually like, but also commute more than what they consider to be optimal.

6 Conclusions

Commuting is for many people a time consuming experience five days a week. The journey from home to work and back is therefore an important aspect of modern life, affecting people's well-being, and it demands difficult decisions about mobility on the labor and housing market.

According to the basic economic idea of compensation, people optimally decide about commuting and only accept a longer commute if they experience an improvement in some other domain, e.g., they get a higher salary or reside in a more attractive living environment. This leads to a set of combinations of job choices and residential locations in which nobody wants to change his or her situation (i.e. an equilibrium) and in which similar people experience the same level of well-being. This prediction is directly tested analyzing panel data on subjective well-being for Germany.

Contrary to the prediction of equilibrium location theory, we find a large negative effect of commuting time on people's satisfaction with life. People who commute 23 minutes (one way), which is the average commuting time in Germany, would have to earn 19 percent more per month on average in order to be fully compensated. This phenomenon is robust to a wide range of possible response biases, and it is not

(37) Economist 1998, special issue on commuting

(38) e.g. Camerer et al. 2003, Frey/Stutzer 2001, Rabin 1998

(39) See Loewenstein/Schkade 1999, Frederick/Loewenstein 1999 and Frey/Stutzer 2004

(40) Weinstein 1982

(41) e.g. Stutzer 2004

(42) Simonsohn 2005

(43) See, e.g., O'Donoghue/Rabin 1999 and Brocas/Carrillo 2003

explained by compensation at the level of households. Moreover, three alternative hypotheses based on institutional restrictions and critical life events find no support in the data. There might well be an explanation in terms of economic costs not yet found and so not yet incorporated into the analysis. This cost factor would be interesting to know, because it potentially relates to a sizeable loss in well-being and should be discussed in urban, regional and traffic politics, as well as explicitly modeled in urban and public economics.

Further research along the lines studied in economics and psychology promises to provide a better understanding of people's decisions about where to live and work and how long the commuting time may be. We favor an explanation based on wrongly predicted adaptation. Decisions about commuting involve a difficult trade-off between socially positively sanctioned income and some loss of spare time that is difficult to assess. A better understanding of the commuting phenomenon has the potential to improve the lot of many people in our commuter societies.

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