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The paradox of the unhappy, growing city: reconciling evidence

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Abstract:
This paper attempts to explain why large cities tend to score low on indices of happiness/life satisfaction, while at the same time experiencing population growth. Using Norwegian survey and register data, we show that different population segments are behind these seemingly contradictory attributes of large cities. A minority of highly mobile citizens are satisfied with life in Norway's biggest city, Oslo, and exhibits positive net in-migration to the city. A majority of less mobile groups are dissatisfied and tend to move out of Oslo, but these flows are too small to determine the overall migration pattern. Our results indicate that the Rosen-Roback framework for analysis of regional quality of life, which builds on the assumption of perfect mobility, is appropriate only for the most mobile segments of the population.

Keywords: Happiness, life satisfaction, quality of life, big cities, mobility

JEL classification: J17, R23, I31

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Sammendrag

Store byer har en tendens til å score lavt på indekser som beskriver innbyggernes lykke og tilfredshet med livet, mens de samme byene samtidig opplever befolkningsvekst. Denne studien ser nærmere på dette paradokset med norske data. Ved hjelp av spørreundersøkelser og registerdata viser vi at ulike segmenter av befolkningen kan stå bak disse tilsynelatende motstridende egenskapene til storbyene.

En minoritet av innbyggere med høy mobilitet rapporterer høyere tilfredshet med livet i Norges største by, Oslo, og har positiv nettoinnflytting til byen. Majoriteten av innbyggerne, som består av mindre mobile befolkningsgrupper, er mindre fornøyde og har en tendens til å bevege seg ut av Oslo. Disse flyttestrømmene er derimot for små til å være bestemmende for det større flyttemønsteret. Resultatene følger et typisk livssyklus-mønster og indikerer at unge, høyt-utdannede og innvandrere er mer fornøyde i store byer, mens eldre, gifte og foreldre er mindre fornøyde med bylivet.

Et annet bidrag fra studien er å anvende Rosen-Roback-modellen til å beskrive stedsattraktiviteten til Oslo relativt til resten av landet. Våre resultater tyder på at Rosen-Roback-rammeverket, som bygger på forutsetningen om perfekt mobilitet, bare egner seg til å beskrive preferansene til de mest mobile delene av befolkningen.

1 Introduction

In this paper we attempt to shed light on the following paradox: studies show that many big and capital cities score low on indices of the population's happiness and life satisfaction, but at the same time, these cities experience population growth and increasing house prices. Why do people move to large cities if their inhabitants are unhappy?

Piper (2015) uses the European Social Survey to examine regional variation in happiness and finds a significant negative association between living in a capital city and happiness for 8 out of 15 countries. In none of the countries is there a significant positive association. Based on a large survey dataset from the Behavioral Risk Factor Surveillance System, Winters and Li (2017) find a negative relationship between life satisfaction and living in US metropolitan areas with more than 1 million inhabitants. A survey conducted by the European Commission (2016) covering 79 EU cities concludes that place satisfaction (satisfaction with living in one's city) is generally lower in big and capital cities. In a series of papers, Okulicz-Kozaryn and coauthors discuss the reasons for unhappiness in large cities, such as social isolation and lack of cohesion, segregation and poverty, crime, pollution, crowding and noise (Berry and Okulicz-Kozaryn, 2009; Okulicz-Kozaryn, 2017; Okulicz-Kozaryn and Mazelis, 2018; Okulicz-Kozaryn and Valente, 2018).

It is a paradox that big and capital cities in general experience higher population growth than the rest of the country when many of the inhabitants are unhappy and dissatisfied with city life. In all of the following countries - Canada, United Kingdom, Germany, New Zealand, Romania, Greece, Portugal, Austria and Belgium - the largest city has increased its share of the country's population during the last decades (World population review, 2019), despite studies finding a negative association between living in the largest city and happiness/life satisfaction (Piper, 2015; Smart, 2012; Morrison, 2011; Lenzi and Perucca, 2016; Lu et al., 2016).

In this paper we use survey and register data from Norway to present one possible reason for this puzzle. We know from the life course literature that geographical mobility is

associated with demographic characteristics of households (Bailey, 2008; Kley, 2011). The probability of relocation is negatively related to age, being married and presence of children, and positively related to educational attainment (Greenwood, 1997). Several scholars argue that cities are particularly attractive for young, educated and single people, that is, the demographic groups that are most mobile (Costa and Kahn, 2000; Clark et al., 2002; Florida, 2002, 2017; Glaeser et al., 2001; Moos, 2016; Okulicz-Kozaryn and Valente, 2019). If mobile groups are more satisfied with life in big cities than less mobile groups, this may explain why the population share of big cities increases although average happiness in big cities is not higher than in the rest of the country.

To test this potential explanation of the big city paradox, we divide the Norwegian population aged 25-66 into mobility quartiles based on an analysis of individuals' propensity to move between regions as a function of demographic characteristics. We find that overall in-migration to the capital is positive, but this result is only driven by the quartile with the highest mobility. For the three quarters of the population with the lowest mobility, net migration is small and negative.

Next, taking advantage of a large national survey dataset with more than 100 000 respondents, we examine the relationship between place satisfaction and living in the capital for each mobility quartile. Only in the most mobile quartile is there a positive association between living in Oslo and satisfaction with one's place of residence. In the two quartiles with lowest mobility, respondents in Oslo are less satisfied than respondents in the rest of the country, whereas in the second highest quartile there is no difference between place satisfaction of Oslo residents and other residents. These results show that there is no contradiction between, on one hand, a big share of the population in large cities being dissatisfied, and, on the other hand, these cities experiencing population growth and upward pressure on house prices. Different population segments are behind these two seemingly contractionary attributes of large cites.

Another contribution of our paper is that we provide a critical evaluation of the Rosen-Roback framework for measuring quality of life. The framework is based on the as-

sumption that firms and households have full mobility, which causes regional prices and wages to reflect the value of location specific amenities (Roback, 1982).[1] In equilibrium, amenities that matter for households will be higher in cities with low real wages. Using extensive datasets on earnings and house transactions, we find that real wages are lower in Oslo for all mobility groups. Hence, according to the Rosen-Roback framework, quality of life should be higher in Oslo than in the rest of the country. For the three-quarters of the population with the lowest mobility, this finding seems to be at odds with our results for place satisfaction and migration flows.

[1] A large number of studies have used the framework to compute regional estimates of the values of local amenities, including Albouy et al. (2013) for Canada, Gibbons et al. (2014) for Britain, Buettner and Ebertz (2009) and Ebertz (2012) for Germany, Dalmazzo and de Blasio (2007) for Italy, Carlsen et al. (2009) for Norway, Garretsen and Marlet (2017) for the Netherlands, Hoehn et al. (1987), Blomquist et al. (1988), Gyourko and Tracy (1991), Gabriel and Rosenthal (2004), Shapiro (2012), Albouy (2012, 2016) and Boualam (2014) for the USA.

2 Population Mobility

Statistics Norway has divided Norway into 90 travel-to-work areas, denoted economic regions, based on information about commuting flows between municipalities. The smallest regions have only about 5 000 inhabitants, whereas the most populous region, the capital Oslo, is twice as big as the second largest region. Oslo has seen substantial population increases over the last decades. From 2002 to 2018, the population swelled by 31 per cent from 513 000 to 673 000 (Statistics Norway, 2018), and in this period the capital's share of total population increased from 11.3 to 12.7 per cent (Statistics Norway, 2018). The rise in house prices was even stronger. From 2002 to 2018, per square meter transaction price of villas in the capital leaped by 184 per cent, whereas the consumer price index only increased by 38 per cent (Statistics Norway, 2019).

2.1 Mobility data

To characterize the mobility of different demographic groups, we investigate relocations between Norwegian regions from 2007 to 2012. We also consider the period 2002-2012 in supplemental analysis. We only consider interregional migration; migration to and from Norway is omitted from the analysis.

From the 2012 population and education registers of Statistics Norway, we collected information for residents aged 25-66 about age, sex, marital status, children in the household, education level and immigration status. Studies have shown these variables to be associated with household mobility (Greenwood, 1997; Machin et al., 2012). We added resident regions in 2012, 2007 and 2002 from the population registry. In 2012, there were 2.63 million people aged 25-66 living in Norway with non-missing demographic information; of these, respectively, 2.53 million lived in Norway in 2007 and 2.47 million lived in Norway in 2002.[2] Hence, the analysis of relocation from 2007 to 2012 is based on 2.53 million

[2]Population is registered January 1, 2012, while education level is registered in October 2011. Information about education level was missing for about 97,000 individuals in the age span 25-66, and family and household information was missing for about 9,000.

persons and the analysis of relocation from 2002 to 2012 is based on 2.47 million persons.

Table 1: Summary statistics. Migration analysis

	Mean
Male	0.505
Married	0.506
Children	0.418
Tertiary education	0.356
Immigrant	0.085
Age 25-29	0.105
Age 30-34	0.108
Age 35-39	0.124
Age 40-44	0.137
Age 45-49	0.131
Age 50-54	0.122
Age 55-59	0.117
Age 60-66	0.155
Change of resident region, 2007-2012	0.108
N	2,530,905

For brevity, our focus will be relocations from 2007 to 2012; the results for 2002-2012 are similar. Table 1 presents the share that changed resident region from 2007 to 2012 and the demographic variables used to explain the decision to relocate: 5-year age intervals, male, married, parent (defined as the presence of a child below 18 in the household), immigrant status (foreign born), and tertiary education (defined as at least one year of completed university/college).[3] Approximately 11 per cent changed resident region between 2007 and 2012. About fifty per cent of the individuals 25-66 are married; approximately 40 per cent have children, while about 35 per cent have higher education. Close to 9 per cent of the population are born abroad.

[3]Characteristics of individuals are anchored to the year 2012, which has implications for interpretation. Some individuals may belong to younger age categories at the time of relocation and may have had different educational and marital statuses. To deal with migration decisions being reflected in future status, for instance relocations preceding child birth, we use the 2012 characteristics and broad socio-demographic categories.

2.2 Migration propensity

In this section, we examine how migration propensities depend on demographic variables and use the results to allocate the population into mobility categories. The following linear probability model is estimated:

$$\begin{aligned} m_i =& Age_i\beta_0 + Age_iMale_i\beta_1 + Age_iMarried_i\beta_2 + Age_iChildren_i\beta_3 + \\ & Age_iTertiaryEducation_i\beta_4 + Age_iImmigrant_i\beta_5 + u_i, \end{aligned}$$

where m_i is an indicator equal to unity if person i changed resident region from 2007 to 2012. Age_i is a vector of 5-year age intervals. The indicator variables - $Male_i$, $Married_i$, $Children_i$, $TertiaryEducation_i$ and $Immigrant_i$ - are interacted with the age vector to allow for age varying effects of demographic variables, and u_i is an error term assumed to have the standard properties.

Table 2: Explaining relocation between regions. Linear probability analysis

	Coefficients	Standard errors
Age 25-29	0.246***	(0.002)
Age 30-34	0.183***	(0.002)
Age 35-39	0.123***	(0.002)
Age 40-44	0.102***	(0.001)
Age 45-49	0.081***	(0.001)
Age 50-54	0.069***	(0.001)
Age 55-59	0.061***	(0.001)
Age 60-66	0.050***	(0.001)
Male x age 25-29	-0.022***	(0.002)
Male x age 30-34	0.020***	(0.002)
Male x age 35-39	0.024***	(0.001)
Male x age 40-44	0.014***	(0.001)
Male x age 45-49	0.010***	(0.001)
Male x age 50-54	0.006***	(0.001)
Male x age 55-59	0.003***	(0.001)
Male x age 60-66	0.003***	(0.001)
Married x age 25-29	0.034***	(0.003)
Married x age 30-34	-0.013***	(0.002)
Married x age 35-39	-0.026***	(0.001)
Married x age 40-44	-0.030***	(0.001)
Married x age 45-49	-0.034***	(0.001)
Married x age 50-54	-0.042***	(0.001)
Married x age 55-59	-0.040***	(0.001)
Married x age 60-66	-0.030***	(0.001)
Children x age 25-29	-0.075***	(0.002)
Children x age 30-34	-0.047***	(0.002)

continued

Table 2: Explaining relocation between regions. Linear probability analysis

	Coefficients	Standard errors
Children x age 35-39	-0.033***	(0.002)
Children x age 40-44	-0.042***	(0.001)
Children x age 45-49	-0.030***	(0.001)
Children x age 50-54	-0.016***	(0.001)
Children x age 55-59	-0.005***	(0.001)
Children x age 60-66	0.009***	(0.002)
Tertiary education x age 25-29	0.167***	(0.002)
Tertiary education x age 30-34	0.155***	(0.002)
Tertiary education x age 35-39	0.080***	(0.001)
Tertiary education x age 40-44	0.033***	(0.001)
Tertiary education x age 45-49	0.015***	(0.001)
Tertiary education x age 50-54	0.011***	(0.001)
Tertiary education x age 55-59	0.010***	(0.001)
Tertiary education x age 60-66	0.011***	(0.001)
Immigrant x age 25-29	-0.002	(0.003)
Immigrant x age 30-34	0.005*	(0.003)
Immigrant x age 35-39	0.042***	(0.002)
Immigrant x age 40-44	0.053***	(0.002)
Immigrant x age 45-49	0.046***	(0.002)
Immigrant x age 50-54	0.040***	(0.002)
Immigrant x age 55-59	0.030***	(0.002)
Immigrant x age 60-66	0.023***	(0.002)
N	2,530,905	
Adj. R-squared	0.196	

Dependent variable: dummy variable equal to one if region in 2007 $\neq$ region in 2012. The specification does not include a constant term.

Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

It follows from the results presented in Table 2 that the propensity to migrate declines monotonically with age. The interaction between age and being male is mainly positive, suggesting that males have higher relocation probabilities. Married people have lower probability to relocate, except for the youngest age group. Parents are less likely to relocate, but the association becomes weaker with age and turns positive for the oldest age group. Persons with higher education have a higher likelihood of relocation, and the associations between education level and mobility are quite large. Compared to natives, immigrants have in general a higher propensity to change region.

Based on the results of Table 2 we compute predicted relocation probabilities for each individual. Persons with the highest predicted migration propensity are native-born married females aged 25-29 without children and with tertiary education, of which 44.7 per cent changed region from 2007 to 2012. The lowest migration propensity have native-born married females aged 50-54 with children and without tertiary education. For this group, the relocation probability is only 1.1 per cent.

Based on the predicted propensity to relocate, we allocate the population aged 25-66 in 2012 into quartiles. All persons in the fourth quartile have relocation probabilities above 14.7 per cent, whereas the first quartile encompasses persons with relocation probabilities below 3.4 per cent.

2.3 Mobility to and from Oslo

Panel A of Table 3 shows 2007-2012 in-migration to and out-migration from Oslo for the whole population aged 25-66 and the four quartiles. Panel B presents the corresponding migration flows from 2002 to 2012. As should be expected, gross migration rates are highest for the most mobile quartiles. Net migration to Oslo is positive for the fourth quartile and negative for the other quartiles. However, since the net flow of the fourth quartile is substantially bigger, overall net migration to Oslo is positive. This pattern is even more pronounced in the period 2002-2012, as mobility fell during the financial crisis.

The positive net inflow in 2002-2012 to Oslo is the sum of a large net inflow in quartile four and smaller net outflows in the other quartiles.

Table 3: Interregional migration to and from Oslo for mobility groups, 2007-2012 and 2002-2012

Quartiles	Population in start year		Moves to Oslo		Moves from Oslo		Net migration to Oslo	
	Norway	Oslo	Number	Relative to population outside of Oslo, per cent	Number	Relative to population in Oslo, per cent	Number	Relative to population in Oslo, per cent
Panel A: migration 2007-2012								
1	660,046	43,590	1,525	0.2	2,741	6.3	-1,216	-2.8
2	661,418	74,343	3,690	0.6	7,297	9.8	-3,607	-4.9
3	609,238	93,766	7,034	1.4	16,308	17.4	-9,274	-9.9
4	600,203	107,943	41,416	8.4	26,380	24.4	15,036	13.9
Full sample	2,530,905	319,642	53,665	2.4	52,726	16.5	939	0.3
Panel B: migration 2002-2012								
1	658,629	45,940	2,821	0.5	6,597	14.4	-3,776	-8.2
2	654,111	79,567	6,677	1.2	16,632	20.9	-9,955	-12.5
3	584,189	94,528	13,808	2.8	28,958	30.6	-15,150	-16.0
4	573,128	70,821	65,014	12.9	20,565	29.0	44,449	62.8
Full sample	2,470,057	290,856	88,320	4.1	72,752	25.0	15,568	5.4

The population samples are grouped into quartiles based on estimated propensity to migrate.

3 Survey data analysis

3.1 Data description

We now explore how persons in the different mobility quartiles evaluate Oslo as a city to live in. For this purpose, we take advantage of a large national postal survey conducted annually by TNS Gallup during 1994-2000 and again in 2003 and 2005. The questionnaire includes the following question about place satisfaction: "All things considered, how satisfied or dissatisfied are you with your municipality as a place to live?" Response alternatives are discrete numbers from 1 to 6, where 6 is 'very satisfied' and 1 is 'very dissatisfied'.

Each year 30 – 40 000 persons received the survey. About 50% returned the questionnaire, of which 98.2 per cent answered the question about place satisfaction. We pool the surveys, producing altogether 158,230 respondents. The surveys included resident municipality and all demographic variables used in our analysis of mobility: age, gender, marital status, children, education level and immigrant status.[4] We omit 15,440 respondents that did not supply one or more of these variables, as well as 31,523 respondents below 25 or above 66 years of age, leaving 111,267 respondents for the analysis.

Table 4 lists means and standard deviations for place satisfaction and demographic variables. Comparison with the total population 1 shows that the survey sample has a somewhat larger share that is married and a lower share of immigrants.

Since we have information on all the demographic variables used to explain relocations between regions, we can use the regression results in Table 2 to compute predicted migra-

[4]With three exceptions, definitions of demographic variables are identical in the mobility and survey datasets. First, in the survey dataset, marital status does not distinguish between marriage and cohabitation, whereas the mobility dataset, which is based on administrative registers, does not have information about cohabitation. Second, the mobility data defines children as 18 years and younger while the survey dataset operates with a threshold of 17 years of age. Third, the mobility dataset defines tertiary education as at least one year of completed college/university, while in the survey dataset, the respondents are asked to state if they have higher education, but the questionnaire does not provide a definition of higher education.

Table 4: Summary statistics. Survey data set

	Mean	St.dev.
Place satisfaction	4.47	1.01
Male	0.486	
Married	0.764	
Children	0.420	
Tertiary education	0.381	
Immigrant	0.020	
Age 25-29	0.097	
Age 30-34	0.139	
Age 35-39	0.147	
Age 40-44	0.140	
Age 45-49	0.131	
Age 50-54	0.128	
Age 55-59	0.102	
Age 60-66	0.117	
N	111,267	

tion propensities for all respondents in the survey dataset. We allocate each respondent of the survey dataset to one of the mobility quartiles based on his/her predicted migration propensity using the same thresholds between quartiles as in the analysis of migration flows.

3.2 Place satisfaction

The following OLS regression is estimated for each of the mobility quartiles:[5]

$$PlaceSatisfaction_{it} = \alpha_{AG} + \alpha_t + \beta_S Oslo_{it} + \beta_M Married_{it} + \beta_C Children_{it} + \beta_T TertiaryEducation_{it} + \beta_I Immigrant_{it} + \epsilon_{it},$$

where $PlaceSatisfaction_{it}$ is the level of satisfaction reported by respondent i in year t, α_{AG} are separate age fixed effects for men and women, α_t are year fixed effects, and

[5]Since answers to survey questions are discrete, the reported regressions were also estimated using ordered probit models, and all conclusions carry over.

$Oslo_{it}$ is an indicator of living in Oslo municipality.[6] $Married_{it}$ is unity if the respondent is married/cohabiting, $Children_{it}$ is a dummy for the presence of children below 17 in the household, $TertiaryEducation_{it}$ is a dummy that is unity if the respondent reported that his/her highest education was college/university, $Immigrant_{it}$ is a dummy for being foreign born, and ϵ_{it} is the error term. The demographic variables are included as explanatory variables in the regression to control for possible effects of demographic variables on place satisfaction and response scale.[7]

Table 5: Effect of living in Oslo on reported place satisfaction for different mobility groups. OLS regressions

	Propensity to migrate			
	First quartile	Second quartile	Third quartile	Fourth quartile
Oslo	-0.175***	-0.080**	0.007	0.090***
	(-0.038)	(-0.031)	(0.022)	(0.024)
N	30,093	29,939	26,292	24,943
Adjusted R-squared	0.020	0.018	0.009	0.009

Fourth quartile is the most mobile group and first quartile the least mobile group.
All equations include year effects, age groups of Table 4 interacted with gender, and dummy variables for gender, married, children, tertiary education and immigrant.
Standard errors clustered at region are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 5 presents the estimated effect of living in Oslo on place satisfaction for the different mobility quartiles. We see that the coefficient of Oslo increases with mobility. In the two lowest quartiles, respondents living in Oslo are less satisfied with their resident municipality than respondents in the rest of the country. In the third quartile there is no significant difference between Oslo and other municipalities, whereas in the highest quartile, place satisfaction is significantly higher in Oslo. These results are quite consistent with migration flows. People in the two lowest mobility quartiles are both less satisfied with living in Oslo and net out-movers from the capital. People in the highest mobility quartile are net in-movers and more satisfied with residency in Oslo.

[6]The Oslo region consists only of Oslo municipality. Therefore, all respondents that live in Oslo municipality also live in the Oslo region, making the Oslo indicators in the survey and mobility datasets identical.

[7]Studies have found associations between demographic variables and happiness/life satisfaction (Diener et al., 1999).

4 Quality of life analysis

In this section we use data on wages and house transactions to compare quality of life in Oslo and the rest of the country for the four mobility groups. The purpose is to examine whether hedonic analyses based on the Rosen-Roback framework gives similar results for Oslo as analyses of survey data and migration flows.

4.1 The Oslo wage premium

Estimates of mobility group specific regional wages are computed for 2001-2010 from four registers administered by Statistics Norway: the population, education, tax and employment registers. The population and education registers give information on all demographic variables needed to allocate workers to mobility quartiles. The tax register gives information about annual income from employment, and the employment register provides yearly information about employment contracts, including the number of hours worked per week. We derive a measure of hourly wage from the income and employment contract data.[8] Excluding persons that are above 66 or below 25 leaves us with yearly data for 2001-2010 for approximately half a million workers. Each worker-year observation is allocated to one of the mobility quartiles dependent on the workers' demographic characteristics of the given year.[9]

The following panel data regression is estimated for each mobility quartile:

$$ln(HourlyWage)_{it} = \alpha_{AG} + \alpha_i + \beta_U UpperSecondaryEduc_{it} + \beta_T TertiaryEduc_{it} + \epsilon_{it},$$

where the dependent variable is the natural logarithm of hourly wages for worker i in

[8] In a given year employees are included if they have at least one full-time contract, no more than two contracts and work 3 months or more. We exclude workers in the primary and public sectors, as the wages in these sectors are to a substantial degree determined by national regulations rather than by market forces.

[9] Since age changes and there may also be changes in education, marital status and children in the household, a worker may move between mobility quartiles over time.

year t, α_{AG} are separate age fixed effects for men and women, and $Oslo_{it}$ is an indicator of living in Oslo. We include indicators of age and education level as these variables change over time and are associated with labour productivity. The variation in the other demographic variables are mainly picked up by the worker fixed effects, α_i. ϵ_{irt} is the error term. The coefficient β_S gives the wage premium of Oslo for each mobility quartile.

A concern is geographical sorting of workers on unobserved worker characteristics like ability. To meet this challenge, we include worker fixed effects in the specification, effectively taking advantage of the panel data properties of our dataset and exploiting worker relocation across regions to control for unobserved heterogeneity (Combes et al., 2008, 2010; Mion and Naticchioni, 2009).

Table 6: Estimated wage and house price premiums of Oslo for different mobility groups

	Wage regressions				House price regressions
	First quartile	Second quartile	Third quartile	Fourth quartile	All
Oslo	0.008	0.028***	0.016***	0.041***	0.318***
	(0.006)	(0.004)	(0.003)	(0.001)	(0.003)
N	1,034,024	1,185,475	1,580,700	2,288,212	427,184
Adj. R-squared	0.739	0.744	0.708	0.653	0.306

The dependent variables are the natural log of hourly wage and house price.

Fourth quartile is the most mobile group and first quartile the least mobile group.

The wage regressions include full set of worker fixed effects, age-by-gender fixed effects and indicators of education level. The full specification of the house price regression is found in Table A1.

Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1.

Table 6 presents the estimated wage premiums for Oslo for the four mobility quartiles. In the first quartile there is no significant wage premium associated with being a resident of Oslo. In contrast, in the fourth quartile the wage level is approximately 4 per cent higher in Oslo and the difference is highly significant. In the second and third quartiles there is also a positive Oslo wage premium, but not as big as for the most mobile workers.

4.2 The Oslo house price premium

The housing transaction register from Statistics Norway encompasses all house transactions except those administered by housing cooperatives. We have data for about 427,000 transactions in the period 2005-2010, including rich data on housing characteristics: square meters, age of house, housing type, type of ownership, number of rooms, housing facilities and location (see Table A.1).

The following regression is estimated across all house transactions:

$$ln(HousingPrice)_{im} = \alpha_m + \beta_S Oslo + Size_{im}\beta_{SIZE} + Age_{im}\beta_{AGE} + Type_{im}\beta_{TYPE} + Facilities_{im}\beta_{FAC} + \epsilon_{im},$$

where i refers to dwelling and m refers to the 72 months in our sample period. The dependent variable is the natural logarithm of transaction price of dwelling i in month m, α_m are month fixed effects, and $Oslo_i$ is unity if the dwelling is located in the Oslo region. $Size_{im}$ is a vector that includes net and gross size of the unit and these values squared, and indicators for the number of rooms and bedrooms. Age_{im} is a vector of age categories, while $Type_{im}$ is a vector of indicators of type of unit (detached, semi-detached, etc.) and ownership characteristics. $Facilities_{im}$ is a vector of facilities and amenities, such as balcony, boat place, garage, garden and fireplace. ϵ_{im} is the error term. The full specification can be found in Table A.1.

The estimated coefficient of Oslo is 0.318 (t-value$\sim$118). Hence, the house price level is

about 32 per cent higher in Oslo compared to the rest of the country. The average budget share of housing in Norway during 2001-2009 was approximately 22 per cent (Statistics Norway, 2012). Assuming that other prices don't vary nationwide, the price level in Oslo is approximately $32 \times 0.22 \approx 7$ per cent higher than in the rest of the country, which is larger than the estimated wage premiums for all mobility quartiles. Hence, based on the standard Rosen-Roback framework for estimating quality of life, the conclusion is that Oslo has lower real wages and therefore the most valuable household amenities for all mobility quartiles, and the difference is biggest for the least mobile. This conclusion seems to be at odds with the findings from the survey and mobility analyses.

5 Concluding remarks

We shed light on the paradox of unhappy growing large cities by comparing place satisfaction and migration flows of demographic groups with different mobility. In addition, we use the Rosen-Roback framework to compute the value of local amenities for the same mobility groups. The three approaches give consistent conclusions for the highest mobility quartile: people in this group report higher place satisfaction in Oslo than in the rest of the country, their net migration flow to Oslo is positive, and they value local amenities higher in Oslo than nationwide.

For the two quartiles with lowest mobility, the analyses of survey data and migration flows yield compatible results – reported place satisfaction is lower in Oslo than in the rest of the country and there is net out-migration from the capital. However, the analysis of local amenities based on the Rosen-Roback framework gives the opposite conclusion: people in the lowest mobility groups value local amenities in Oslo higher than in the rest of the country.

Since the Rosen-Roback framework rests on the assumption of perfect mobility, it should not be surprising that analysis based on this framework produce results consistent with analyses of place satisfaction and migration flows only for the most mobile demographic groups. For demographic groups with low mobility, the assumption behind the Rosen-Roback framework is violated, and local wages and prices may therefore not accurately reflect the value of local amenities (Bayer et al., 2009).

Our interpretation of the results is that, due to high moving costs, some persons in low mobility groups, typically elderly people, married couples with children and the low-educated, decide to remain in Oslo despite being dissatisfied with the capital as a place of residence. The low real wages of these groups thus do not reflect high valuation of local amenities, as implied by the Rosen-Roback framework, but rather bad alternatives: remain unhappy in a city where wages are low relative to prices or incur large psychic and pecuniary costs of relocation.

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Table A.1: Estimated house price premium of Oslo. OLS regression

	Coefficients	Standard errors
Oslo	0.318***	(0.003)
Size (in square meters)	0.002***	(0.000)
Size squared	-0.000***	(0.000)
Gross size (in square meters)	0.002***	(0.000)
Gross size squared	-0.000***	(0.000)
Age: 1-5 years	-0.116***	(0.005)
Age: 6-10 years	-0.174***	(0.005)
Age: 11-20 years	-0.269***	(0.005)
Age: 21-30 years	-0.350***	(0.005)
Age: 31-50 years	-0.406***	(0.005)
Age: 51-100	-0.385***	(0.005)
Age: >100 years	-0.294***	(0.006)
House type: detached	0.154***	(0.020)
House type: semi-detached	0.243***	(0.021)
House type: townhome	0.313***	(0.021)
House type: apartment	0.297***	(0.020)
House type: multi-family residential/apartment building	0.273***	(0.043)
House type: farm	0.047*	(0.026)
Ownership: share	-0.206***	(0.002)
Ownership: stock	-0.025***	(0.007)
Ownership: bond	-0.724***	(0.061)
Other type of ownership	-0.165***	(0.038)
2 rooms	0.231***	(0.007)
3 rooms	0.260***	(0.007)
4 rooms	0.298***	(0.007)
5 rooms	0.337***	(0.007)
6 or more rooms	0.392***	(0.008)
1 bedroom	-0.088***	(0.004)

continued

Table A.1: Estimated house price premium of Oslo. OLS regression

	Coefficients	Standard errors
2 bedrooms	0.058***	(0.004)
3 bedrooms	0.142***	(0.004)
4 bedrooms	0.195***	(0.004)
5 bedrooms	0.206***	(0.006)
6 or more bedrooms	0.169***	(0.009)
1st floor	-0.033***	(0.006)
2nd floor	-0.008	(0.006)
3rd floor	0.029***	(0.006)
4th floor	0.033***	(0.006)
5th floor	0.065***	(0.008)
6th floor	0.049***	(0.011)
Higher than 6th floor	-0.014	(0.009)
Renovated	0.073***	(0.005)
Renovated x age	-0.006***	(0.000)
Balcony	-0.009***	(0.003)
Boat place	0.202***	(0.034)
Garage	0.009**	(0.004)
Fireplace	0.110***	(0.004)
Common washroom	-0.077***	(0.005)
Garden	0.074***	(0.004)
Elevator	0.045***	(0.005)
Owner lives in unit	0.107***	(0.002)
Constant	13.652***	(0.031)
Observations	427,184	
Adj. R-squared	0.306	

Dependent variable: Dependent variable is log(house price).

Month-by-year fixed effects are included in the estimation, as well as indicators of missing information.

Robust standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1