ISSN 1503-299X

WORKING PAPER SERIES

No. 1/2015

For whom are cities good places to live?

Fredrik Carlsen and Stefan Leknes
Department of Economics, Norwegian University of Science and Technology

Department of Economics

Norwegian University of Science and Technology
N-7491 Trondheim, Norway
http://www.ntnu.edu/econ/working-papers

For whom are cities good places to live?

Fredrik Carlsen[a], Stefan Leknes[a,1,*]

[a]*Norwegian University of Science and Technology, Department of Economics, Dragvoll, N-7491 Trondheim, Norway*

Abstract

We use Norwegian data to evaluate the consumption hypothesis of geographical variation in educational attainment, i.e. that well-educated people particularly value the amenities provided by cities. Our results cast doubts on the hypothesis. After-tax real wages are higher in rural areas than in urban areas, suggesting that Norwegians are willing to forego purchasing power in order to enjoy urban amenities, but the urban purchasing power premium is roughly equal across education groups. Moreover, survey data in which respondents evaluate local amenities indicate a broad consensus between education groups about the advantages and disadvantages about city life as well as about the relationship between city size and the quality of local amenities.

Keywords: Quality of life, urban amenities, population size, education, mobility

JEL: R11, R12, J3, J61

*Corresponding author

Email addresses: fredrik.carlsen@svt.ntnu.no (Fredrik Carlsen), stefan.leknes@svt.ntnu.no (Stefan Leknes)

[1]Phone: +47 735 96 760

1. Introduction

Well-educated people are attracted to cities all over the world. Ulubasoglu and Cardak (2007) collected (unbalanced) panel data of rural and urban educational attainment from the UNESCO Education Yearbook for 56 countries, and found that, in every country and every year, average years of schooling were higher in urban areas than in rural areas.

Urban scholars have suggested two reasons why well-educated persons prefer to live in cities. First (the 'production hypothesis'), agglomeration effects in dense areas raise the productivity more for skilled workers than for less skilled workers (Glaeser, 1999, Glaeser and Resseger, 2010). Second (the 'consumption hypothesis'), well-educated people particularly value the variety in consumption and leisure activities that cities provide (Brueckner et al., 1999, Florida, 2002, Glaeser et al., 2001). In this paper, we use several micro data sets to evaluate the plausibility of the consumption hypothesis as explanation for the geographical distribution of educational attainment in Norway.[2]

Most empirical tests of the consumption hypothesis are based on the theoretical framework of Roback (1982) in which local wages and prices are determined by spatial location decisions of workers and firms, extended to accommodate heterogeneous workers. These studies essentially consider whether the return on educational attainment vary by population size or quality of life (Adamson et al., 2004, Black et al., 2009, Lee, 2010). The rationale is that, if local prices are the same for all education groups, regional nominal wage differences provide information about the purchasing power that education groups are willing to forego in order to live in areas with better amenities. If more educated workers gain less or lose more by moving to urban from rural areas, they must place a higher value on city life. Whereas existing studies of the consumption hypothesis typically find that the urban wage gap is a negative function of education level (Adamson et al., 2004, Lee, 2010), other studies find that the urban wage premium is increasing in education/skills (Bacolod et al., 2009, Glaeser and Maré, 2001, Gould, 2007, Rosenthal and Strange, 2008b).

Tests of the consumption hypothesis based on the equilibrium framework rest on the assumption that mobility is sufficiently high to equalize utilities between areas. However, since mobility is increasing in education level (Etzo, 2008, Machin et al., 2012), this assumption is more plausible for the highly educated. If utilities are equalized for some education groups, but not for others, geographic variation in return to education may not provide unbiased information about educational differences in quality of life. Moreover, existing studies do not net federal taxes out of wage differences (Albouy, 2012), or allow budget shares, and therefore, the local price level, to vary across education groups (Hansen et al., 1996, 1998).

Another empirical test of the consumption hypothesis, suggested by Dalmazzo and de Blasio (2011), is based on survey data in which respondents evaluate area-specific amenities. For each amenity, regressions are

[2] The five largest Norwegian municipalities have about one fourth of the total population, but more than half of all college graduates (Statistics Norway, 2012).

estimated explaining reported satisfaction with the amenity as a function of city size, allowing the effect of city size to vary with the education level of the respondent. For several amenities, the authors find that the estimated effect of city size on reported satisfaction increases with education level and conclude that qualities of large cities are more valuable to highly educated persons.

The Dalmazzo and de Blasio (2011) test of the consumption hypothesis rests on the assumption that the response scale used by respondents when making subjective assessments does not vary systematically with urban scale, or that any geographic differences in response scale are the same for all education groups. However, studies from other research areas suggest that the validity of this assumption cannot be taken for given. For instance, health economists have found that response scale used when reporting subjective health varies both between education groups and between urban and rural areas (Bago d'Uva et al., 2008b,a). Moreover, psychologists have shown that reporting behavior in general depends on personality traits (Diener and Lucas, 1999), which may exhibit regional variations (Jokela, 2009, Rentfrow et al., 2008).

In this paper, we improve on the existing studies of the consumption hypothesis based on the equilibrium framework by using a range of data sources, including several micro data sets, to compute area- and education specific estimates of after-tax real wages. We then use a large survey data set comprising 123 000 respondents to improve on the consumption hypothesis test by Dalmazzo and de Blasio (2011). The relation between area population and reported satisfaction with local amenities is estimated for different education groups using a question about local weather conditions together with area data about meteorological variables to control for educational differences in response scale. Finally, we use the survey data set to compute area-specific indicators of average satisfaction with local amenities, and include these indicators as explanatory variables in regressions explaining education specific after-tax real wages.

The main conclusion of these exercises is that there are only moderate differences between education groups in evaluation of local amenities. The urban-rural gap in after-tax real wages is roughly equal for all education groups. The education groups also agree on whether a particular amenity is an urban amenity or an urban disamenity. The effects of population size on reported satisfaction with local amenities are quite similar across education groups, and the same area satisfaction indicators explain variation in after-tax real wages for all education groups. These results cast doubt on the consumption hypothesis as a plausible explanation for the urban-rural gap in educational attainment.

The rest of the paper is organized as follows. The next section presents some basic facts about Norwegian regions. Section 3 presents our analysis of educational differences in quality of life based on the equilibrium framework. In Sections 4 and 5, we use survey data to explore educational differences in evaluation of amenities and the role of amenities in explaining regional variation in quality of life. In Section 6, we examine the relationship between net regional migration flows and quality of life, and Section 7 presents concluding remarks.

2. Norwegian regions

Statistics Norway has divided Norway into 90 travel-to-work areas, denoted economic regions, based on information about commuting flows between municipalities. Interregional variation in population size is considerable. In 1994 the most populous region counted 477 781 inhabitants, while the smallest region had 6012 inhabitants. There were 9 urban regions with 100 000 or more inhabitants and 45 regions with less than 25 000 inhabitants. In our analyses we will focus on population size rather than density, as Norwegian cities are small by international comparison and most regions have large unpopulated areas. Consequently, population size better reflects better the urban scale of the region.

Table 1: Descriptive analysis of educational attainment and mobility

	Primary education			Secondary education			Tertiary education		
Population:[a]	< 25	$25 - 100$	$100 <$	< 25	$25 - 100$	$100 <$	< 25	$25 - 100$	$100 <$
Education shares:									
Year 1994	0.228	0.215	0.189	0.614	0.596	0.549	0.157	0.188	0.263
Average 1994-2002	0.187	0.177	0.154	0.633	0.608	0.549	0.180	0.215	0.298
Year 2002	0.151	0.145	0.124	0.650	0.619	0.549	0.199	0.237	0.326
Net migration rate (%):									
Average 1994-2002	0.104	0.241	-0.031	-0.421	0.082	0.341	-2.100	-0.520	1.430

[a] Year 1994 regional population aged 25-66 (in 10^3).

The net migration rate is computed as net migration relative to beginning of year regional population for each group. Net migration rates are weighted by beginning of year regional population of the education group, and education shares are weighted by beginning of year regional population.

Our analysis uses data for 1994-2002; due to the Norwegian tax reform that came into force in 1992, comparable data of earnings for earlier years are not available, and the best data source of house prices, Statistics Norway's transaction data base, has comparable data through 2002.[3] We consider three education groups: primary education (9 years of schooling or less), secondary education (10-12 years of education) and tertiary education (13 years of education or more).

The population and education registers of Statistics Norway are used to compute beginning of year population shares of the three education groups for each region and year and net migration rates (net in-migration scaled by beginning of year population) for each region, year and education group.[4] The population share of persons with tertiary education increases in regional population size, and the gap between small and large regions

[3]Fewer housing attributes are available after 2002.

[4]The education register covers the whole population and gives information about the highest completed education level in the beginning of October each year.

became bigger during the period we consider (Table 1). The shares of persons with primary and secondary education are decreasing in population size. Due to the general increase in the education level of the working age population, the population share of persons with tertiary education increased in big as well as small regions. The population share of persons with secondary education remained stable in big regions and increased in other regions, whereas the population share of persons with primary education decreased across the board.

Table 1 shows that the education groups exhibited distinct migration patterns during 1994-2002. Persons with tertiary education moved to regions with more than 100 000 inhabitants from other regions. Persons with secondary education moved from regions with less than 25 000 to large and medium-sized regions. Persons with only primary education moved to small and medium-sized regions.

3. The equilibrium approach to quality of life

In this section, we use the equilibrium framework pioneered by Roback (1982) and extended by Albouy (2012) to study how quality of life varies with regional population.

3.1. Conceptual framework

Households differ with respect to education level and consume three goods: housing, (other) non-tradables and tradables. Households are homogenous within education groups, mobile between regions and supply one unit of labor in their home region. Nominal wages, tax rates, prices and quality of life vary between regions, and - within regions - nominal wages, house prices, budget shares and quality of life may vary between education groups. For each education group e, migration equilibrium requires that utility is constant across regions:

$$V^e(Y^e_r, P^e_{H,r}, P^e_{NT,r}, P^e_{T,r}, Q^e_r) = \overline{V^e} \tag{1}$$

where $V^e(\cdot)$ is a well-defined indirect utility function for education group e. Y^e_r is post-tax disposable income in region r, $P^e_{H,r}$, $P^e_{NT,r}$ and $P^e_{T,r}$ are, respectively, the prices of housing, non-tradables and tradables, and Q^e_r is quality of life.

An expression for quality of life can be derived from (1) by using first order Taylor series expansion around the national averages, Roy's identity, and dividing by national average post-tax income, Y^e:

$$\begin{aligned}\tilde{Q}^e_r = \frac{P^e_Q(Q^e_r - Q^e)}{Y^e} &= \frac{X^e_H P^e_H}{Y^e}\frac{(P^e_{H,r} - P^e_H)}{P^e_H} + \frac{X^e_{NT} P^e_{NT}}{Y^e}\frac{(P^e_{NT,r} - P^e_{NT})}{P^e_{NT}} \\ &+ \frac{X^e_T P^e_T}{Y^e}\frac{(P^e_{T,r} - P^e_T)}{P^e_T} - \frac{(Y^e_r - Y^e)}{Y^e}\end{aligned} \tag{2}$$

where P_Q^e is the amenity price, X_H^e, X_{NT}^e and X_T^e are national average quantities of the three goods, and $\tilde{Q}_r^e$ is quality of life measured as share of post-tax average income and as deviation from the national average. Since the budget shares sum to unity, (2) can be written as:

$$\tilde{Q}_r^e = \alpha_H^e \frac{P_{H,r}^e}{P_H^e} + \alpha_{NT}^e \frac{P_{NT,r}^e}{P_{NT}^e} + \alpha_T^e \frac{P_{T,r}^e}{P_T^e} - \frac{Y_r^e}{Y^e} \tag{3}$$

where α_H^e, α_{NT}^e and α_T^e are the respective goods' national budget shares. The price of tradable goods are assumed to be the same nationally:[5]

$$\frac{P_{T,r}^e}{P_T^e} = 1. \tag{4}$$

Moreover, we assume that non-tradables are produced with the same level of efficiency everywhere, implying that the price of non-tradables is a weighted sum of the factor prices of production:[6]

$$\frac{P_{NT,r}^e}{P_{NT}^e} = \delta_H \frac{P_{H,r}}{P_H} + \delta_L \frac{W_r(1+s_r)}{\overline{W_r(1+s_r)}} + \delta_T \tag{5}$$

where W_r is regional wage level, and s_r is the pay roll tax rate paid by employers in the region. $\overline{W_r(1+s_r)}$ is the national average cost per unit labor, $P_{H,r}$ is the regional house price and δ_H, δ_L and δ_T are the national factor shares of housing, labor and a composite of traded goods.

Post tax income, Y_r^e, is wages minus taxes:

$$\frac{Y_r^e}{Y^e} = \frac{W_r^e - t_r(W_r^e)}{\overline{W_r^e - t_r(W_r^e)}} \tag{6}$$

where $\overline{W_r^e - t_r(W_r^e)}$ is national average post tax income. The tax function, $t_r(W_r^e)$, is region-specific as inhabitants in some Norwegian regions in rural areas benefit from lower federal taxes. We include local taxes in the tax function. Locally financed government services are therefore included in Q_r^e.

Quality of life for education group e in region r is obtained by inserting from (4)-(6) in (3):

$$\tilde{Q}_r^e = \alpha_H^e \frac{P_{H,r}^e}{P_H^e} + \alpha_{NT}^e \delta_H \frac{P_{H,r}}{P_H} + \alpha_{NT}^e \delta_L \frac{W_r(1+s_r)}{\overline{W_r(1+s_r)}} + \alpha_T^e + \alpha_{NT}^e \delta_T - \frac{W_r^e - t_r(W_r^e)}{\overline{W_r^e - t_r(W_r^e)}}. \tag{7}$$

3.2. Empirical calibration

To calibrate (7) we use: micro data about earnings, house prices and residence size, regional data about tax rates and allowances, and aggregate data about budget and factor shares. Since prices and wages vary over the business cycle, we compute the regional means for quality of life over the period 1994-2002.

[5] In the robustness analysis we modify this assumption.

[6] In the robustness analysis we consider a situation where the prices of non-tradables are equal nationally.

3.2.1. Regional wage level

Our estimates of education specific regional wage levels, W_r^e, are computed from three registers administered by Statistics Norway: the tax, employment and education registers. The tax register gives information about income from employment and self-employment, capital income, and government transfers during the calendar year for the whole population.

The employment register gives yearly information about employment contracts for all employees during a particular week in November. We consider only employees working more than 30 hours.[7] We exclude persons above 60 as some workers may choose to reduce work hours in the years before retirement, and persons below 25, since some young workers are part-time students. This leaves us with yearly data during 1994-2002 for $1.05-1.3$ million workers.

The standard time norm of the working week is determined by the national labor market organizations and therefore do not vary among regions. However, there may be regional variations in work hours due to variations in the prevalence of overtime work. Yearly wage income will tend to underestimate the wage level in regions with relative few overtime hours per worker, and overestimate the wage level in regions with many overtime hours per worker. Unfortunately, studies of regional variation in work hours are missing for Norway. We therefore assume that work hours for full time workers are the same in every region.[8]

We know the employment status of a worker in a particular week only. If the worker is unemployed, underemployed or outside the labor force for part of the year, yearly wage income will underestimate the true wage level. We therefore add work-related government benefits to wage income. Net capital income is not added since we want to describe regional variation in income opportunities, and capital income and costs are independent of residence.

Income from self-employment may accrue from work outside standard work hours or from periods without full employment. The two cases have different implications: there is an argument for adding income from periods without full-time employment to wage income, whereas income accruing from extra work should not be added. Since we do not know which of the two cases is more common, we exclude workers that received more than 10% of their income from self-employment. For the rest of the workers, income from self-employment is added to wage income.

A concern is the geographical sorting of workers on unobserved worker characteristics like ability. Unobserved characteristics might be correlated with the urban scale and consequently create biased estimates. To meet this challenge we take advantage of the panel data properties of our dataset and use worker relocation across regions to control for unobserved heterogeneity (Combes et al., 2008, 2010, Mion and Naticchioni, 2009). The

[7] The employment register does not have information about actual weekly work hours, only whether an employee worked more than 30 hours per week, 20-30 hours or < 20 hours.

[8] In the robustness analysis, we use estimates of the population size elasticity of work hours across US metropolitan areas reported by Rosenthal and Strange (2008a) to adjust our estimates of W_r^e.

following panel data equation is estimated for each education group e:

$$W^e_{irt} = \beta^e_r + \beta^e_i + X^e_{irt}\beta^e_X + \epsilon^e_{irt}, \quad (8)$$

where W^e_{irt} is log individual annual income for worker i in region r and year t, β^e_r is a set of region fixed effects, β^e_i is a set of worker fixed effects, and X^e_{irt} is a vector of worker characteristics (gender and age dummies for 5-year intervals). The estimated region fixed effects, $\exp(\hat{\beta}^e_r)$, scaled by the national average, are used as our measure of the regional wage level for education group e.

The first row in Table 2 presents the relative regional wage level by education level and region size. In all education groups wages increase with regional population; wages are 4−6 % higher in regions with more than 100 000 inhabitants compared to regions with less than 25 000 inhabitants. The urban wage premium is somewhat lower for workers with tertiary education.

Table 2: Descriptive analysis. Averages for 1994-2002

	Primary education			Secondary education			Tertiary education		
Population:[a]	< 25	$25-100$	$100 <$	< 25	$25-100$	$100 <$	< 25	$25-100$	$100 <$
Wages:									
$\frac{W^e_r}{W}$	0.881	0.903	0.935	0.974	0.990	1.024	1.252	1.259	1.296
$\frac{W^e_r - t_r(W^e_r)}{W - t(W)}$	0.911	0.924	0.946	0.983	0.990	1.014	1.196	1.195	1.220
House prices:									
$\frac{P^e_{H,r}}{P^e_H}$	0.852	1.071	1.458	0.849	1.071	1.471	0.846	1.071	1.486
$\frac{P_{H,r}}{P_H}$	0.849	1.071	1.472	0.849	1.071	1.472	0.849	1.071	1.472
Budget shares:									
α^e_H	0.1945	0.1945	0.1948	0.1924	0.1926	0.1929	0.1876	0.1879	0.1883
α^e_{NT}	0.2817	0.2817	0.2816	0.2750	0.2749	0.2748	0.2775	0.2774	0.2773
α^e_T	0.5238	0.5238	0.5235	0.5326	0.5325	0.5323	0.5349	0.5347	0.5344

[a] Regional population (in 10^3) in 1994.

3.2.2. Post-tax income

During the period we consider, central and local authorities levied the following personal taxes: central and local income and wealth taxes,[9] local government property tax[10] and central government tax on the imputed value of residential housing. In the following, we disregard the national house tax as the proceeds were small and only a minority of house owners paid the tax due to generous allowances.

We collected information about income and wealth tax rates and allowances from government documents for each year and region. Information about local property taxes paid by the owner of a standardized apartment was collected by Norwegian Household Finances.[11]

For each year, region and education level, we compute total income and wealth taxes paid by a taxpayer who received average regional wages for his/her education category, had no net capital income[12] and did not claim extra allowances due to care of children or spouse with low income. To these tax payments were added average property taxes paid by the owner of a standardized apartment scaled by the average number of employed persons per household.[13] Finally, total taxes were subtracted from regional wages to produce education and region specific estimates of post-tax income, Y_r^e, for each year.

The second row of Table 2 shows that taxes reduce regional income differentials, this result is consistent with what Albouy (2009) finds for the US. Accounting for taxes reduces relative differences between large and small regions from 4% to 2% for workers with tertiary education, and from 6% to 4% for workers with primary education.

3.2.3. Regional housing cost

To compute regional housing costs, we use data about house transactions as owner-occupied houses comprise almost 80% of all houses in Norway (Stm 23 (2003-2004)).[14] The transaction data base of Statistics Norway contains information about all house transactions with the exception of transactions administered by housing co-operatives. Data for about 285 000 house transactions were available for the period 1994-2002.

The transaction database does not contain information about buyers or sellers. However, in 1997, Statistics

[9]Proceeds from income and wealth taxes are shared by central and local government. Tax rates and allowances are set by the parliament and do not vary between regions.

[10]Local government can decide whether to levy a residential property tax and, if they choose to impose the tax, set the rate within an interval.

[11]The data are available for each municipality during 1996-98. We assume that, in each region, property tax payment for a standardized apartment was the same share of average post-tax income in later and earlier years.

[12]During the period we consider, average household net financial wealth was close to zero.

[13]Data about property tax payments were collected by Norwegian Household Finances for an apartment that was larger than the average apartment. We therefore scale property tax payments with the ratio of the size of the standardized apartment to the size of an average apartment. Regional data about average apartment size and the number of employed persons and households were collected from Statistics Norway.

[14]Unfortunately, there are too few observations of rented apartments for Norway to estimate regional variation in rents.

Norway conducted a Survey of Living Conditions that provides information about apartment size and education level of respondents.[15] We use the survey to obtain estimates of average apartment size for our three education groups.[16]

Since the education groups are not evenly distributed across regions (Table 1), and average apartment size is higher in rural areas than in cities, we adjust raw average apartment size by estimating the following regression:

$$SIZE_i = \beta_a + \beta_1 PrimaryEducation_i + \beta_2 SecondaryEducation_i + \beta_3 TertiaryEducation_i + u_i \quad (9)$$

where $SIZE_i$ is apartment size in square meters for respondent i, $PrimaryEducation_i$, $SecondaryEducation_i$ and $TertiaryEducation_i$ are indicators for the education level of respondent i, and β_a is a set of fixed effects for the respondent's living area.[17] $\hat{\beta}_a + \hat{\beta}_1$, $\hat{\beta}_a + \hat{\beta}_1$ and $\hat{\beta}_a + \hat{\beta}_3$ are area-adjusted estimates of average apartment size for the respective education groups. We find that the average apartment of a respondent with tertiary education is 23 (11) square meters larger than the average apartment of a respondent with primary education (secondary education).[18]

We now use the transaction database to obtain regional estimates of the costs of each education group's average apartment. The following regression is fitted across all 285 000 transactions:

$$p_{irt} = \beta_{0r} + \beta_{1r} SIZE_{irt} + X_{irt}\beta + \beta_t + \epsilon_{irt} \quad (10)$$

where p_{irt} is log transaction price of apartment i in region r and year t, β_{0r} is a set of regional fixed effects, β_{1r} is a set of regional fixed effects interacted with apartment size, $SIZE_{irt}$, X_{irt} is a vector of other housing attributes (age, age squared, the number and types of rooms, travel distance to municipal centre) and β_t is a set of year dummy variables. Interactions between regional fixed effects and apartment size are included to allow price differences between small and big apartments to vary across regions.[19]

Our estimate of housing costs of education group e in region r is:

$$\exp(\hat{\beta}_{0r} + \hat{\beta}_{1r} \widehat{SIZE}^e), \quad (11)$$

[15] 3190 out of 3363 respondents provided information about apartment size. Respondents were not asked about the age of the apartment.

[16] The respondent's education level is not provided by the respondent but is added by Statistics Norway using the national education register. Respondents can therefore be allocated to one of our three education groups.

[17] To avoid identification of individual respondents, the public survey data file contains information only about the county of the respondent (there are 19 counties) and the size of his/her city/village (5 categories). We include fixed effects for all possible combinations of county and city/village size.

[18] $\hat{\beta}_a + \hat{\beta}_1 = 120.4$, $\hat{\beta}_a + \hat{\beta}_2 = 131.7$, $\hat{\beta}_a + \hat{\beta}_3 = 143.5$.

[19] In our data set, the hypothesis that coefficients of $SIZE_{irt}$ are equal across regions is overwhelmingly rejected.

scaled by the corresponding national average, where $\widehat{SIZE}_e$ is the estimate of area-adjusted average apartment size for education group e from the Survey of Living Conditions. The third row of Table 2 presents our estimates of education specific regional house prices, $P^e_{H,r}$. In large regions (> 100 000 inhabitants), house prices are 71-76% higher than in small regions (< 25 000) and 36-39% higher than in medium-sized regions (25 000 – 100 000). Transaction prices are more sensitive to variation in house price in urban areas than in rural areas. Our estimate for the price of housing that enters into production of non-tradables, $P_{H,r}$, is predicted regional prices for the national average apartment size (131.9 square meters).

3.2.4. Budget and factor shares

Statistics Norway performs annual consumer expenditure surveys and publishes national average budget shares for the main categories of goods and services.[20] We divide consumer spending into housing, non-tradables and tradables and compute the budget shares of these three categories.[21]

Unfortunately, education specific budget shares are not presented by Statistics Norway. However, from the tax and education registers we have information about regional income for each education group. Several studies find that the income elasticity of housing is below unity (Hansen et al., 1996, 1998, Mayo, 1981, Røed Larsen, 2014). Røed Larsen (2002) used annual cross-sections of the Norwegian consumer expenditure survey to estimate the income elasticity of household budget share on housing for 1986 through 1998. His mean point estimate for the years 1994-98 is 0.85. For each region, we calibrate the budget share of housing for the three education groups, assuming an income elasticity of 0.85 and - since we don't have information on regional budget shares - scale the regional budget shares of housing to make the weighted average budget share of housing in the region equal to the national average.[22] The last rows of Table 1 presents national average budget shares for the three education groups; we see that the budget share of housing is decreasing in education level and increasing in regional population size.

The non-tradable sector's factor shares of housing, labor and traded inputs are taken from Valentinyi and Herrendorf (2008).[23] That gives the following factor weights; $\delta_H = 0.23$, $\delta_L = 0.65$ and $\delta_T = 0.12$.

3.3. Relation between quality of life and population size

Estimates of quality of life, $\tilde{Q}^e_r$, for each region, education level and year are obtained by inserting our estimates for income, prices, budget shares and factor shares in (7). The first panel in Table 3 presents regressions across the 90 regions explaining average regional quality of life 1994-2002 as a function of log

[20] Only three year averages are reported. We therefore compute budget shares for 1994-96, 1997-99 and 2000-02.

[21] Housing costs include actual rents for non-owners and imputed interest plus maintenance for owners. Non-tradables include recreation and cultural services, transport and communication, health care, education, personal care and other services.

[22] We use the education shares of workers in the region as weights. We increase or decrease the budget shares of non-tradables and tradables proportionally so that the budget shares equal to unity for each education group and region.

[23] The study of Valentinyi and Herrendorf (2008) uses US data. Unfortunately, equivalent studies for Norway are not available.

average regional population. The coefficient of log population is positive and statistically significant for each education group. The relation between quality of life and regional population size is somewhat stronger for the more educated. One unit increase in log population raises quality of life relative to the national average by 5.1% for the primary education group, 5.3% for the secondary education group, and 5.9% for the tertiary education group.

The most populous region in Norway has about 90 times more inhabitants than the least populated region. This means that the most populous regions have higher quality of life in the range of 23-27% of the national average compared to the most scarcely inhabited areas.

Table 3: Association between regional quailty of life and region population

	Primary education	Secondary education	Tertiary education
Log(population)	0.051	0.053	0.059
	(7.61)	(8.55)	(8.61)
Adj. R-Square	0.374	0.482	0.436
N	90	90	90
<10 000	Reference category		
10 000-25 000	0.040	0.032	0.033
	(1.50)	(1.38)	(1.16)
25 000-50 000	0.064	0.065	0.073
	(2.33)	(2.74)	(2.46)
50 000-100 000	0.113	0.111	0.122
	(4.21)	(4.49)	(4.14)
100 000-300 000	0.157	0.156	0.168
	(4.44)	(4.70)	(4.70)
>300 000	0.211	0.217	0.240
	(3.81)	(3.86)	(4.10)
Adj. R-Square	0.326	0.425	0.375
N	90	90	90

Data: 90 regions, mean of years 1994-2002. Robust t-statistics in parentheses. In the lowest panel population size categories are computed using regional population in 1994.

In the lower panel of Table 3, we use indicators for regional population size as covariates. The regressions give the same conclusion as the regressions with log population as covariate: regional quality of life increases monotonically with population size.

3.4. Robustness analysis

In this section, we examine the robustness of the relationship between quality of life and log population for the three education groups. We stack the data sets of the three groups, allowing us to obtain estimates for all groups in one regression. Column (1) of Table 4 replicates the results for the baseline alternative. We see that the coefficient of log population is significantly higher for persons with tertiary education compared to those with primary education.

3.4.1. Unemployment

The conceptual framework outlined in section 2 disregards unemployment by assuming that location decisions depend only on amenities and real post-tax income. In practice, the level of unemployment in a region will affect expected long-run income via the probabilities of job loss and finding a new job. We use the unemployment and employment registers of Statistics Norway to compute the unemployment rate for each region, education group and year. In the second column of Table 4, we enter the education specific average unemployment rates during 1994-2002 as additional covariates. Comparing columns (1) and (2) shows that coefficients of education groups converge somewhat and differences are no longer statistically significant.

3.4.2. Work hours

Due to lack of data about actual work hours, we assumed that annual non-capital income of full time workers is a good proxy for the wage level. However, if work hours per year are correlated with population size, our estimates of the relation between quality of life and regional scale will be biased. We are not aware of Norwegian studies of geographical variation in wage hours. Using US census data, Rosenthal and Strange (2008a) find that professionals, but not non-professionals, have longer work days in densely populated areas.[24] Their estimate of the elasticity of population density for professionals aged 30-40 is 0.0011. We use this estimate to adjust work hours of persons with tertiary education, assuming that the elasticity of population size for Norwegians with tertiary education is the same as the elasticity of population density for American professionals.

In column (3), post-tax income has been scaled by adjusted work hours.[25] Naturally, the association between population size and quality of life is not affected for persons with primary or secondary education. For persons with tertiary education, the coefficient of log population increases from 0.059 to 0.071, the reason being that post-tax hourly wages of persons with tertiary education decrease more in populous areas than in rural areas compared to the baseline specification.

[24] The authors define professionals to be workers that have at least a master's degree and work in Census occupations categorized as 'professional' or 'technical'.

[25] We scaled Y_r^e of persons with tertiary education with $(1 + 0.0011 \times \frac{Pop_r - Pop_{min}}{Pop_{min}})$, where Pop_r is regional population and Pop_{min} is population in the least populous region. Note that we should scale Y_r^e rather than W_r^e because taxes are computed from annual wages, not hourly wages.

Table 4: Robustness analysis

	(1)	(2)	(3)	(4)
Log(population) × Primary education	0.051	0.057	0.051	0.052
	(7.58)	(8.39)	(7.58)	(7.49)
Log(population) × Secondary education	0.053	0.055	0.053	0.053
	(8.52)	(9.51)	(8.52)	(8.51)
Log(population) × Tertiary education	0.059***	0.062	0.071***	0.058**
	(8.58)	(8.83)	(9.13)	(8.69)
Adj. R-Square	0.424	0.525	0.460	0.424
N	270	270	270	270
	(5)	(6)	(7)	
Log(population) × Primary education	0.047	0.045	0.030	
	(7.12)	(6.66)	(6.19)	
Log(population) × Secondary education	0.049	0.047	0.034	
	(8.11)	(7.52)	(7.55)	
Log(population) × Tertiary education	0.055***	0.053***	0.039***	
	(8.18)	(7.67)	(7.73)	
Adj. R-Square	0.388	0.365	0.326	
N	270	270	270	

Pooled sample: 90 regions, 3 education groups, means for years 1994-2002. Robust t-statistics clustered on region in parentheses. All regressions include constant and indicators for secondary and tertiary education. Stars indicate that the coefficient is significantly different from the coefficient of the primary education group, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

(1) Replication of baseline results in the upper panel of Table 3.

(2) Education specific unemployment rates are included as covariates.

(3) Annual work hours of tertiary education group are assumed to depend on regional population size. Size of association between work hours and population is based on estimates for professionals reported in Rosenthal and Strange (2008a).

(4) House prices are estimated from all housing transactions, so that the education groups face the same regional house prices.

(5)-(6) Prices of tradable goods are assumed to depend on regional population size. In (5) computed prices reflect transportation cost utilizing estimates from Hovi and Hansen (2010). In (6) prices are computed utilizing estimates from Handbury and Weinstein (2014).

(7) Prices of non-tradables are the same everywhere.

3.4.3. House prices

In our baseline alternative, we assume that the regional house price faced by each education group is the predicted regional price of an apartment with size equal to the area adjusted national average size of the residences of the education group. To check how this assumption affects our results, we consider an alternative where all education groups face the same regional house prices, $P_{H,r}$, which are the predicted regional prices of a residence with size equal to that of the national overall average. Comparison of columns (1) and (4) in Table 4 shows that results are hardly affected.

3.4.4. Prices of tradables

In the baseline alternative, prices of tradable goods are assumed to be the same in every region. In practice, prices may vary because of transportation costs. There are no Norwegian studies of regional differences in the transportation costs of goods consumed within the region. A survey of Norwegian firms in retail industry, manufacturing and construction concluded that transport costs represent on average 6% of total costs, varying from 7% in Northern Norway to 4% in the southernmost counties (Hovi and Hansen, 2010). Although this study does not provide direct information about geographical variation in the retail prices of tradable goods, the study indicates the order of magnitude of transportation costs. In column (5) of Table 4, we assume that $P_{NT,r}$ is 6% higher in the least populous region than in the most populous region, and a linear and decreasing function of population size between the two extremes. Since the price level increases in rural areas relative to urban areas, the effect of this assumption is to reduce the urban-rural quality of life gap for all education groups. However, the changes are modest.

Using US purchase data for households, Handbury and Weinstein (2014) find that aggregate grocery prices are lower in more populous areas. Their estimate of the elasticity of population size on price level is -0.011. In column (6) of Table 4, we use this estimate to adjust prices of tradables. This lowers the coefficient of log population to $0.045-0.052$, reflecting that living in an urban region becomes cheeper. However, differences between education groups remain the same.

3.4.5. Prices of non-tradables

In our baseline alternative, the efficiency of production of non-tradables is assumed to be the same in all regions so that the price of non-tradables is a function of regional housing prices and wages. To check whether this assumption is important for our conclusions, we consider an alternative where efficiency is highest in areas with high factor prices, so that the price of non-tradables is equal across regions. We see that the coefficient for log population falls to 0.30-0.39 since non-tradables become cheaper in urban areas. However, the association between quality of life and regional population size remains highly significant, and differences between education groups are hardly affected.

3.5. Concluding remarks

Our analysis has produced two robust results: i) quality of life is increasing in regional population size for all three education groups, and ii) preferences for urban versus rural areas are increasing in education level. However, preference differences between education groups are modest. They are largest when urban residents with tertiary education are assumed to work longer hours than other urban residents (column (3), Table 4). But even then, educational differences are not very large: persons with tertiary education consider the largest region to have 31% higher quality of life than the smallest region relative to national average income, whereas the corresponding number for persons with primary education is 23%. Educational preference differences of this magnitude seem difficult to reconcile with the radically different migration flows of the education groups documented in Table 1.

4. Using survey data to study satisfaction with local amenities

In this section we use a survey data set to study the relation between regional population size and subjective valuations of local amenities for different education groups.

4.1. Survey dataset

We take advantage of a large national survey conducted annually by TNS Gallup during 1994-2000. Each year, 30-40 000 persons were asked to rate different aspects of their resident municipality on a discrete scale from 1 to 6, where 6 is 'very satisfied' and 1 is 'very unsatisfied'. The survey also included a question about the education level of the respondent. The response alternatives to this question were: 'college/university', 'secondary education' and 'primary education'.[26] About 50% returned the questionnaire. We pool the surveys, producing altogether 124 664 respondents. We omit 1686 respondents that did not report their education level, leaving 122 978 respondents for the analysis. Of these, 27 997 (22.8%) respondents reported that they had no more than primary educations, 56 109 respondents (45.6%) reported 'secondary education', and 38 872 reported 'college/university'.

From the survey questionnaire, we selected 10 questions (Table 5).[27] The questions cover several local amenities, including public services, secondary and higher education, culture, leisure activities, safety, public transportation, and shopping.[28] [29] Table 5 lists regional means and standard deviations for each amenity. Respondents seem to be most satisfied with safety and least satisfied with public transportation. The question

[26]The questionnaire does not explain what is required to qualify for 'college/university'. Therefore, the education categories are not necessarily identical to the categories used in the analysis of regional quality of life in Section 3.

[27]TNS Gallup demands a substantial charge per question/year. The charge limited the number of amenities that could be studied.

[28]In Norway, primary schools are part of public services.

[29]The questions about safety in neighborhood and in the center were not asked in 1994.

about opportunities for shopping has the highest response rate (91.7%). The lowest response rate has the questions about leisure activities (84.0%) and public transportation out of the municipality (84.6%).

4.2. Empirical specification and results

For each of the questions, we estimate the following regression: [30]

$$\begin{aligned} Satisfaction_{irt} = \beta_t + X_{irt}\beta_X + & \\ & \beta_2 Log(population_{rt}) \times PrimaryEducation_{irt} \quad + \\ & \beta_3 Log(population_{rt}) \times SecondaryEducation_{irt} + \\ & \beta_4 Log(population_{rt}) \times TertiaryEducation_{irt} \quad + \epsilon_{irt} \end{aligned} \tag{12}$$

where $Satisfaction_{irt}$ is reported satisfaction by respondent i in region r and year t, X_{irt} is a vector of indicators for sex, age (5-year intervals) and education level, and $Population_{rt}$ is population size in region r and year t. $PrimaryEducation_{irt}$, $SecondaryEducation_{irt}$ and $TertiaryEducation_{irt}$ are indicators turned on if respondent i in region r and year t reported that he/she has, respectively, primary education, secondary education or college/university education, β_t is a set of year effects and ϵ_{irt} is the error term. t-statistics are adjusted to account for clustering at the regional level.

The results are reported in the first columns, denoted 'Unadj.', in Table 5. We see that the education groups agree whether an amenity is an urban amenity or disamenity. For all three education groups, population size is positively associated with satisfaction with cultural amenities, leisure activities, secondary/tertiary education, public transportation and shopping opportunities, whereas less populous areas score higher on satisfaction with public services, safety and living conditions for children.[31] The quantitative effect of population size on reported satisfaction is strongest for secondary/tertiary education, public transportation within the municipality, safety in the municipal center and shopping opportunities.[32] For persons with tertiary education, the relation between population size and cultural activities are also quantitatively important.

Whereas the results show agreement about whether an amenity improves or deteriorates with population size, persons with higher education have 'stronger' views about the urban-rural dimension in the sense that the (absolute value) of the estimated coefficient on Log(population) is higher. The satisfaction of a person with tertiary education who moves from rural to urban areas improves more for some amenities and decreases

[30]Since the dependent variables are discrete, we also estimated ordered probit models and the results were very similar to the results reported here.

[31]The reader is perhaps surprised that satisfaction with public services is negatively associated with population size. However, in Norway, the municipalities provide a large share of public services, and per capita income is highest in small municipalities due to generous central transfers to municipalities in rural areas.

[32]The difference in expected satisfaction between the most and least populous regions in Norway is in the order of one standard deviation: 1.5-2.2 (standard deviation = 1.62) for secondary/tertiary education, 1.3-1.8 (st.dev. = 1.40) for shopping opportunities, 1.8-2.0 (st.dev. = 1.47) for safety in the municipal center and 1.2-1.3 (st.dev. = 1.54) for public transportation within the municipality.

more for other amenities compared to movers with less education. This may reflect that urban scale is a more important determinant of quality of life for the highly educated. However, it is also possible is that education groups use the response scale differently. It is well know that reporting heterogeneity may bias estimates of disparities in self-reported measures of well-being (Bago d'Uva et al., 2008a,b, Johnston et al., 2009, Lindeboom and van Doorslaer, 2004).

Suppose highly educated persons are more inclined to report that they are 'very satisfied' or 'very dissatisfied' than less educated persons for any given amenity level. Then a regression of reported satisfaction against an explanatory variable correlated with the amenity level, such as population size, is likely to produce a higher regression coefficient for the highly educated, even if education groups agree on the actual amenity level.

Table 5: Determinants of reported satisfaction with local amenities

	Public services			Cultural amenities			Leisure activities			Secondary/tertiary education			Safety in neighborhood		
	Unadj.	Adj.	Adj.	Unadj.	Adj.	Adj.	Unadj.	Adj.	Adj.	Unadj.	Adj.	Adj.	Unadj.	Adj.	Adj.
Mean 1994-2000	3.88	4.21	4.20	3.98	4.29	4.27	4.01	4.33	4.31	3.90	4.21	4.20	5.26	5.59	5.69
(st. dev.)	(1.15)	(1.33)	(1.31)	(1.20)	(1.35)	(1.33)	(1.25)	(1.39)	(1.38)	(1.62)	(1.78)	(1.77)	(1.02)	(1.22)	(1.20)
Residual	-	-	0.206	-	-	0.166	-	-	0.216	-	-	0.060	-	-	0.145
			(24.27)			(13.12)			(22.48)			(2.65)			(14.33)
Log(pop.)×Prim. educ.	-0.058	-0.073	-0.054	0.054	0.065	0.086	0.036	0.042	0.069	0.341	0.421	0.449	-0.171	-0.213	-0.198
	(-2.91)	(-2.95)	(-2.18)	(1.81)	(1.75)	(2.19)	(1.27)	(1.22)	(2.08)	(5.97)	(5.91)	(6.14)	(-5.43)	(-5.42)	(-4.84)
Log(pop.)×Sec. educ.	-0.053	-0.057	-0.031*	0.119***	0.127***	0.151***	0.037	0.039	0.067	0.387*	0.414	0.436	-0.207***	-0.221	-0.201
	(-3.10)	(-3.13)	(-1.52)	(2.70)	(2.70)	(3.15)	(1.32)	(1.32)	(2.21)	(5.98)	(5.98)	(6.06)	(-6.41)	(-6.41)	(-5.58)
Log(pop.)×Tert. educ.	-0.074	-0.073	-0.042	0.224***	0.224***	0.250***	0.073	0.074	0.105	0.502***	0.502	0.524	-0.227***	-0.227	-0.204
	(-4.16)	(-4.18)	(-2.09)	(3.07)	(3.08)	(3.56)	(2.17)	(2.19)	(3.45)	(6.57)	(6.57)	(6.69)	(-6.39)	(-6.41)	(-5.01)
R-Square	0.039	0.125	0.165	0.064	0.115	0.137	0.057	0.092	0.128	0.105	0.121	0.127	0.059	0.215	0.243
N	108 847	108 847	98 542	104 441	104 441	94 563	103 291	103 291	93 465	106 037	106 037	96 073	101 949	101 949	98 402

	Safety in municipal center			Public transit within municipality			Public transit out of municipality			Opportunities for shopping			Living conditions for children		
	Unadj.	Adj.	Adj.	Unadj.	Adj.	Adj.	Unadj.	Adj.	Adj.	Unadj.	Adj.	Adj.	Unadj.	Adj.	Adj.
Mean 1994-2000	4.58	4.95	4.95	3.26	3.54	3.52	3.72	4.03	4.04	4.53	4.91	4.89	4.51	4.88	4.87
(st. dev.)	(1.28)	(1.47)	(1.45)	(1.54)	(1.74)	(1.73)	(1.47)	(1.66)	(1.64)	(1.40)	(1.58)	(1.57)	(1.11)	(1.29)	(1.28)
Residual	-	-	0.180	-	-	0.137	-	-	0.153	-	-	0.132	-	-	0.201
			(11.47)			(8.89)			(11.29)			(5.90)			(19.44)
Log(pop.)×Prim. educ.	-0.400	-0.495	-0.470	0.262	0.324	0.346	0.108	0.134	0.144	0.248	0.304	0.327	-0.135	-0.167	-0.147
	(-5.84)	(-5.81)	(-5.55)	(4.34)	(4.30)	(4.55)	(2.82)	(2.81)	(2.90)	(4.94)	(-5.51)	(5.09)	(-4.87)	(-4.88)	(-3.89)
Log(pop.)×Sec. educ.	-0.426	-0.454	-0.430	0.292	0.312	0.329	0.145*	0.154	0.162	0.313***	0.334	0.354	-0.182**	-0.195	-0.173
	(-5.76)	(-5.76)	(-5.29)	(4.54)	(4.54)	(4.63)	(3.04)	(3.04)	(3.03)	(5.67)	(5.68)	(5.87)	(-4.30)	(-4.30)	(-3.67)
Log(pop.)×Tert. educ.	-0.441	-0.441	-0.415	0.281	0.281	0.297	0.175**	0.174	0.186	0.406***	0.406**	0.427**	-0.259***	-0.258**	-0.227*
	(-5.63)	(-5.64)	(-4.85)	(4.97)	(4.98)	(5.33)	(4.00)	(3.99)	(4.29)	(7.93)	(7.96)	(8.53)	(-4.24)	(-4.24)	(-3.42)
R-Square	0.124	0.200	0.227	0.109	0.158	0.165	0.073	0.125	0.136	0.090	0.155	0.165	0.050	0.164	0.203
N	98 710	98 710	95 604	105 988	105 988	97 201	104 004	104 004	95 530	112 739	112 739	102 055	104 805	104 805	94 767

Pooled sample of 7 annual surveys, 1994-2000, 122 978 respondents. Amenities are ranked by respondent on a scale from 1 to 6, where 6 is “Very satisfied” and 1 is ”Very unsatisfied“. Education level is evaluated by himself/herself. OLS analysis with t-statistics adjusted for clustering on regions in parentheses. Stars indicate significantly different effect from primary education group, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

4.3. Controlling for differences in response scale

The standard methods used to control for variation in response scale are repeated observations on individuals and vignette evaluations (King et al., 2004). Neither method is applicable here. The survey data set consists of cross-sectional samples, and vignette questions were not included in the survey. Therefore, an alternative method proposed by Carlsen and Johansen (2004) is applied. The answers to a question about a local amenity for which there exists a reasonably accurate objective indicator are used to estimate educational differences in response scale. These estimates are subsequently used to adjust the answers to questions about other local amenities.

We use answers to a question about local climate to control for differences in response scale. An objective measure of the climatic conditions at the local level was created by the government commission that designed the present system for financing of Norwegian specialist health care (NOU, 2008). Based on studies of geographic variation in consumption of specialist health services, the commission computed an index that runs from 0 to 1 where 0 denotes the 'worst' climate and 1 the 'best' climate.[33] The index assigns a unique value to each Norwegian municipality based on historical meteorological data (temperature by season, precipitation, latitude).

The TNS Gallup questionnaire contains the following question about the respondent's resident municipality:

How satisfied/dissatisfied are you with the weather and climatic conditions?

As for the urban amenities, respondents were asked to indicate a discrete number from 1 to 6 where 6 corresponds to 'very satisfied' and 1 to 'very dissatisfied'. 104 569 respondents evaluated their local climate and reported their education level.

The first column of Table 6 shows the following OLS regression:

$$\begin{aligned} ClimateSatisfaction_{imt} = \beta_t + X_{imt}\beta_X + \\ \beta_1 ClimateIndex_m \times PrimaryEducation_{imt} \quad + \\ \beta_2 ClimateIndex_m \times SecondaryEducation_{imt} + \\ \beta_3 ClimateIndex_m \times TertiaryEducation_{imt} \quad + \epsilon_{imt} \end{aligned} \tag{13}$$

where $ClimateSatisfaction_{int}$ is satisfaction with the local weather and climate conditions reported by respondent i in municipality m and year t, X_{imt} is a vector of personal characteristics (sex, age (5-year intervals), and education level), and $ClimateIndex_m$ is the index used to finance specialist health care. The standard errors are clustered at the municipal level.

We see that the climate index is a strong and very significant determinant of reported satisfaction with the

[33] The climate index used by the government assigns 1 to bad climate and 0 to good climate. We have inverted the scale.

climate for all education groups.[34] However, the estimated coefficient of the climate index is increasing in education level, suggesting that education level may affect how the response scale is used.[35]

We now use the estimated effects of the climate index on reported satisfaction with the climate to adjust the answers to the other questions. For each of the local amenities, we create a new variable, 'Adjusted satisfaction':

$$AdjustedSatisfaction_{irt} = \begin{cases} Satisfaction_{irt} \times \frac{\hat{\beta}_3}{\hat{\beta}_1} & \text{if } PrimaryEducation_{irt} = 1, \\ Satisfaction_{irt} \times \frac{\hat{\beta}_3}{\hat{\beta}_2} & \text{if } SecondaryEducation_{irt} = 1, \\ Satisfaction_{irt} & \text{if } TertiaryEducation_{irt} = 1. \end{cases}$$

where $\hat{\beta_1} - \hat{\beta_3}$ are the estimates of $\beta_1 - \beta_3$ from the first column of Table 6.

Basically, the adjustment 'stretches' out the answers of respondents with primary and secondary education, while leaving the answers of respondents with tertiary education unchanged. The second column of Table 6 illustrates how the adjustment affects the regression coefficients of the climate index. We see that, after adjustment of reported satisfaction with the climate, the regression coefficients of the three education groups become almost identical.[36]

The second columns, denoted 'Adj.', of Table 5 report the results of regression (12), using adjusted satisfaction instead of satisfaction as dependent variable. Due to the adjustment, the estimated effects of population size becomes stronger (the coefficients increase in absolute size) for persons with primary or secondary education but is not affected for persons with tertiary education. For most amenities, the association between population size and reported satisfaction becomes more similar across education groups. After adjustment, the coefficients of population size are not statistically different for respondents with primary and secondary education (the only exception is cultural amenities); without adjustment, the coefficients are significantly different for six of ten amenities. The coefficients of population size are statistically different for respondents with primary and tertiary education for six amenities with adjustment and for three amenities without adjustment.

Another possible source of bias is variation in response scale between regions. Reported happiness with different domains of life has been shown to depend on personality traits, such as extraversion, neuroticism, optimism and self-esteem (Diener and Lucas, 1999), and personality traits may exhibit regional variations (Jokela, 2009, Rentfrow et al., 2008). To obtain a proxy for the general propensity to provide favorable assessments of local amenities, the residual of each respondent is computed from the regression reported in the second column of Table 6. The residual can be interpreted as a proxy for the difference between

[34] The correlation across municipalities between average reported satisfaction and the climate index is 0.71 for respondents with primary education, 0.75 for respondents with secondary education and 0.72 for respondents with tertiary education.

[35] Education level also affects average reported satisfaction for a given climate index, but this effect is picked up by the vector of personal characteristics.

[36] The coefficients do not become identical because the adjustment affects the regression coefficients of all explanatory variables.

Table 6: Satisfaction with weather and climatic conditions - with and without climate index adjustment

	Satisfaction with weather and climatic conditions	Adjusted satisfaction with weather and climatic conditions
Mean 1994-2000	4.28	4.63
(st. dev.)	(1.27)	(1.43)
Climate index × Primary education	3.531	4.366
	(14.32)	(14.30)
Climate index × Secondary education	4.091***	4.368
	(16.24)	(16.24)
Climate index × Tertiary education	4.368***	4.367
	(16.75)	(16.79)
R-Square	0.176	0.229
N	104 569	104 569

Pooled sample of 7 annual surveys, 1994-2000, 104 569 respondents. Satisfaction with weather and climatic conditions is ranked by respondents on a scale from 1 to 6, where 6 is "Very satisfied" and 1 is "Very unsatisfied". Education level is evaluated by himself/herself.

Ordinary least square analysis with t-statistics adjusted for clustering on regions in parentheses. Stars indicate significantly different effect from primary education group, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

the respondent's subjective perception of the local climate and the objective quality of the local climate as measured by the climate index.

The third columns in Table 5 show the results of regressions where adjusted satisfaction is dependent variable, and the residual is included as an additional regressor. The residual has a positive and very significant impact on reported satisfaction with local amenities. Thus, a person that is inclined to be satisfied with one local amenity tends to give favorable evaluations of other local amenities. However, the estimated coefficients of population size change very little for either education group, reflecting that the residual exhibits more variation within than between regions.[37]

4.4. Concluding remarks

The analysis suggests that education groups have rather similar evaluations of local amenities. The education groups agree about whether an amenity is an urban amenity or a disamenity, and once we control for differences in response scale, there is also considerable agreement about the quantitative effect of regional population size on the quality of amenities. Similar to what we found for quality of life in Section 3, educational differences in evaluation of amenities seem too small to explain educational differences in migration patterns.

5. Relation between quality of life and satisfaction with local amenities

Even though education groups agree about the quality of local amenities in different regions, they could still disagree about which amenities are most important for overall quality of life. In this section we present education specific estimates of the relation between our estimate of quality of life and local amenities. To describe local amenities we use the TNS Gallup survey dataset to compute mean satisfaction for each amenity and region; we pool the years 1994-2000 and the three education groups to reduce measurement error. Mean satisfaction is adjusted for interregional variation in the sex- and age distribution of respondents using hedonic regressions.[38]

5.1. Cross-sectional regressions

Mean satisfaction is highly correlated across regions for three groups of amenities: (i) the two dimensions of public transportation, (ii) cultural and leisure activities, and (iii) the two dimensions of safety and living conditions for children. We use only one amenity from each of the three groups. Thus, seven local amenities are used to explain variation in quality of life across regions.

[37] A regression of the residual against a full set of regional fixed effects gives $R^2 = 0.087$.

[38] We also adjusted for differences in response scale using the results in Table 6, but the results were virtually the same as those reported here.

Table 7: Association between regional quality of life and reported satisfaction with local amenities

	Primary education			Secondary education			Tertiary education		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Public services	-0.002			0.020			0.014		
	(-0.06)			(0.60)			(0.36)		
Cultural amenities	0.041	0.035		0.034	0.029		0.049	0.045	
	(1.28)	(1.18)		(1.22)	(1.16)		(1.47)	(1.53)	
Secondary/Tertiary education	0.007	0.010		0.012	0.016		0.004	0.007	
	(0.54)	(0.85)		(0.93)	(1.30)		(0.31)	(0.55)	
Living conditions for children	-0.022			-0.051			-0.037		
	(-0.61)			(-1.50)			(-0.99)		
Public transp. out of municipality	0.048	0.047	0.053	0.039	0.035	0.044	0.052	0.049	0.055
	(2.80)	(2.58)	(3.06)	(2.55)	(2.15)	(2.67)	(2.93)	(2.65)	(3.04)
Opportunities for shopping	0.053	0.060	0.079	0.046	0.060	0.083	0.061	0.072	0.092
	(2.32)	(3.29)	(5.41)	(2.09)	(3.38)	(5.96)	(2.73)	(3.88)	(6.06)
Climate/weather conditions	0.039	0.039	0.041	0.034	0.034	0.037	0.047	0.038	0.049
	(4.32)	(4.23)	(4.65)	(4.15)	(4.03)	(4.43)	(4.98)	(4.97)	(5.40)
Adjusted R-Square	0.450	0.460	0.458	0.500	0.500	0.490	0.511	0.518	0.513
N	90	90	90	90	90	90	90	90	90

OLS regressions across regions. Robust t-statistics in parentheses. Dependent variable: Average quality of life 1994-2000.

Explanatory variables: Mean satisfaction with amenities (1994-2000) reported by all respondents in region, adjusted for respondents' sex, age (5-year intervals) and education level using hedonic regressions.

Table 8: Robustness analysis

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A: Primary education								
Public transportation out of municipality	0.053		0.054	0.052	0.053	0.036	0.050	0.051
	(3.06)		(3.10)	(3.08)	(3.12)	(2.66)	(2.85)	(2.41)
Opportunities for shopping	0.079		0.080	0.074	0.071	0.053	0.081	0.071
	(5.41)		(5.39)	(5.22)	(4.96)	(5.07)	(5.22)	(4.33)
Climate and weather conditions	0.041		0.042	0.041	0.040	0.024	0.040	0.046
	(4.65)		(4.71)	(4.70)	(4.64)	(3.53)	(4.48)	(4.37)
Adjusted R-Square	0.458		0.464	0.444	0.436	0.364	0.481	0.383
N	90		90	90	90	90	85	90
Panel B: Secondary education								
Public transportation out of municipality	0.044		0.044	0.043	0.043	0.027	0.039	0.045
	(2.67)		(2.67)	(2.71)	(2.75)	(2.23)	(2.40)	(2.80)
Opportunities for shopping	0.083		0.083	0.077	0.074	0.057	0.085	0.076
	(5.96)		(5.96)	(5.84)	(5.53)	(5.98)	(5.73)	(5.35)
Climate and weather conditions	0.037		0.037	0.036	0.036	0.020	0.036	0.037
	(4.43)		(4.43)	(4.50)	(4.44)	(3.24)	(4.22)	(4.50)
Adjusted R-Square	0.490		0.490	0.480	0.471	0.416	0.521	0.454
N	90		90	90	90	90	85	90
Panel C: Tertiary education								
Public transportation out of municipality	0.055	0.058	0.054	0.054	0.055	0.038	0.050	0.039
	(3.04)	(2.89)	(3.02)	(3.08)	(3.12)	(2.78)	(2.75)	(2.41)
Opportunities for shopping	0.092	0.108	0.091	0.086	0.083	0.065	0.095	0.092
	(6.06)	(6.17)	(6.10)	(5.92)	(5.65)	(6.12)	(5.90)	(6.73)
Climate and weather conditions	0.049	0.051	0.049	0.049	0.048	0.033	0.047	0.042
	(5.40)	(5.06)	(5.35)	(5.49)	(5.45)	(4.74)	(5.15)	(4.98)
Adjusted R-Square	0.513	0.527	0.508	0.504	0.497	0.462	0.547	0.523
N	90	90	90	90	90	90	85	90

OLS regressions across regions. Robust t-statistics in parentheses.

(1) Replication of column (3), (6) and (9) in Table 7.

(2) Annual work hours of tertiary education group are assumed to depend on regional population size. Size of association between work hours and population is based on estimates for professionals reported in Rosenthal and Strange (2008a).

(3) Education groups face the same regional house prices.

(4)-(5) Prices of tradable goods are assumed to depend on regional population size. In (4) computed prices reflect transportation cost utilizing estimates from Hovi and Hansen (2010). In (5) prices are computed utilizing estimates from Handbury and Weinstein (2014).

(6) Prices of non-tradables are the same everywhere.

(7) Sample restricted to regions with more than 300 respondents (85 out of 90 regions).

(8) Mean satisfaction is computed separately for each education group.

Table 7 presents, for each education group, three regressions explaining our baseline estimates of quality of life from Section 3 as a function of mean satisfaction with local amenities. In columns (1), (4) and (7), all seven mean satisfaction variables are included. The coefficients of mean satisfaction with public services and living conditions for children are insignificant and small/negative for all education groups, and the two amenities are excluded in the remaining regressions. In the last regressions − columns (3), (6) and (9) − only mean satisfaction variables that are statistically significant at $p = 0.05$ are included.

We see from Table 7 that results are very similar for the three education groups. The same three amenities − public transportation, shopping opportunities and the climate − have positive and statistically significant effects on quality of life. Moreover, the magnitudes of the coefficients are comparable across education groups; the coefficient of opportunities for shopping is largest, whereas the coefficients of the two other amenities are similar.

5.2. Robustness analysis

The first column of Table 8 replicates the results from Table 7 (the most parsimonious specifications). In the next five columns, dependent variables are the five alternative measures of quality of life presented in columns (3)-(7) in Table 4. In the seventh column of Table 8, we omit five small regions where less than 300 respondents completed the survey questionnaire about local amenities. In column (8), mean satisfaction is computed from subsets of respondents according to reported education level.[39] We see that the results are very robust. The estimated effects of local amenities on quality of life exhibit limited variation across specifications, and the three amenity variables are statistically significant in every regression.

6. Migration, quality of life and productivity

So far, we have found only modest differences between education groups in preferences for urban amenities. However, there are substantial differences between education groups in the size and direction of migration flows (Table 1). If mobility responses to quality of life disparities differ between education groups, regional variation in quality of life may affect education shares, even if education groups have broadly similar evaluations of quality of life in different parts of the country. In this section, we examine and compare the relation between regional migration and quality of life for the three education groups.

[39] The education level reported by respondents is not necessarily consistent with our definition of education level.

Table 9: Association between migration, quality of life and productivity

	(1)	(2)	(3)
Quality of life × Primary education	0.007		0.001
	(0.82)		(0.15)
Quality of life × Secondary education	0.055***		0.032***
	(6.17)		(2.89)
Quality of life × Tertiary education	0.144***		0.088***
	(8.66)		(3.61)
Productivity × Primary education		0.014	0.013
		(1.77)	(1.78)
Productivity × Secondary education		0.067***	0.041***
		(8.76)	(4.51)
Productivity × Tertiary education		0.272***	0.140***
		(13.22)	(3.68)
Adj. R-Square	0.784	0.770	0.821
N	270	270	270

Pooled sample: 90 regions, 3 education groups, means for years 1994-2002. Dependent variable: Education specific migration rate. Robust t-statistics clustered on regions in parentheses. All regressions include constant and indicator for secondary and tertiary education.

Stars indicate that the coefficient is significantly different from the coefficient of the primary education group, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

6.1. Cross-sectional regressions

A data set of 270 observations (90 regions × 3 education groups) are created by stacking education specific migration and quality of life variables. The first column of Table 9 shows the results of the following regression:

$$NetMigration_r^e = \beta_0 + \beta_1 Q_r^{PrimaryEducation} D^1 + \beta_2 Q_r^{SecondaryEducation} D^2 + \beta_3 Q_r^{TertiaryEducation} D^3 + \epsilon_r^e \quad (14)$$

where $NetMigration_r^e$ is average net in-migration rate (in percentage) to region r during 1994-2002 for education group e , and $Q^{PrimaryEducation} - Q^{TertiaryEducation}$ are our baseline estimates of quality of life in region r for persons with, respectively, primary, secondary and tertiary education. $D^1 - D^3$ are dummy variables for the three education groups.

We see that the relationship between quality of life and net in-migration exhibits large differences between education groups. Whereas quality of life is positively and significantly related to net in-migration for persons with secondary or tertiary education, there is no association between migration and quality of life for persons with primary education. The coefficient of quality of life is almost three times larger for persons with tertiary education than for persons with secondary education.

Of course, this result does not prove any causal relationship between quality of life and migration flows since migration decisions may be affected by other factors correlated with quality of life, and because quality of life may be affected by the composition of the population, and therefore by migration flows (Diamond, 2013). A potentially omitted variable is the region's labor productivity. If workers move towards regions where they are more productive and therefore receive higher wages, and quality of life and productivity is positively correlated, we may erroneously conclude that workers are attracted to regions with higher quality of life. As proxy for labor productivity of education group e in region r, we use the region's relative gross wages (average during 1994-2002), including payroll taxes:

$$Productivity_r^e = \frac{W_r^e(1+s_r)}{\overline{W_r^e(1+s_r)}} \quad (15)$$

For all three education groups, quality of life and productivity are strongly correlated. The correlations across regions are, respectively, 0.77 for persons with tertiary education, 0.69 for persons with secondary education and 0.55 for persons with primary education. The strong positive relationship between quality of life and productivity contrasts with computations for the US by Chen and Rosenthal (2008) and Gabriel and Rosenthal (2004). These authors find correlations close to zero.[40]

The regression of the second column of Table 9 includes productivity, but not quality of life, as determinant of net in-migration. Productivity is positively associated with net in-migration for all education groups, and the estimated coefficient is increasing in education level.

[40]However, the estimates of productivity for the US include cost of land in addition to cost of labor.

Table 10: Robustness: Association between migration, quality of life and productivity

	(1)	(2)	(3)	(4)	(5)	(6)
Quality of life × Primary education	0.004	-0.002	0.007	0.001	0.006	0.000
	(0.55)	(-0.22)	(0.82)	(0.15)	(0.73)	(0.04)
Quality of life × Secondary education	0.054***	0.032***	0.055***	0.032***	0.055***	0.032***
	(6.05)	(2.83)	(6.17)	(2.89)	(6.17)	(2.88)
Quality of life × Tertiary education	0.144***	0.087***	0.133***	0.086***	0.144***	0.087***
	(9.08)	(3.73)	(10.10)	(4.17)	(8.38)	(3.50)
Productivity × Primary education		0.014		0.013		0.014
		(2.01)		(1.78)		(1.88)
Productivity × Secondary education		0.043***		0.041***		0.041***
		(4.42)		(4.51)		(4.51)
Productivity × Tertiary education		0.142***		0.128***		0.143***
		(3.75)		(3.44)		(3.76)
Adj. R-Square	0.792	0.831	0.796	0.827	0.780	0.819
N	270	270	270	270	270	270
	(7)	(8)	(9)	(10)	(11)	(12)
Quality of life × Primary education	0.008	0.003	0.008	0.002	0.011	0.006
	(0.92)	(0.29)	(0.89)	(0.27)	(1.02)	(0.58)
Quality of life × Secondary education	0.057***	0.034***	0.058***	0.033***	0.073***	0.042***
	(6.29)	(2.96)	(6.15)	(2.85)	(7.17)	(3.35)
Quality of life × Tertiary education	0.147***	0.087***	0.148***	0.086***	0.179***	0.090**
	(8.16)	(3.42)	(8.15)	(3.40)	(6.37)	(2.89)
Productivity × Primary education		0.012		0.012		0.012
		(1.67)		(1.70)		(1.63)
Productivity × Secondary education		0.040***		0.041***		0.047***
		(4.54)		(4.62)		(5.95)
Productivity × Tertiary education		0.147***		0.150***		0.185***
		(3.88)		(3.98)		(5.64)
Adj. R-Square	0.777	0.818	0.774	0.817	0.725	0.810
N	270	270	270	270	270	270

Pooled sample: 90 regions, 3 education groups, means for years 1994-2002. Dependent variable: Education specific migration rate. Robust t statistics clustered on regions in parentheses. All regressions include constant and indicator for secondary and tertiary education.

Stars indicate that the coefficient is significantly different from the coefficient of the primary education group, *** $p < 0.01$, ** $p < 0.05$, * $p < 0.1$.

(1)-(2) Education specific unemployment rates are included as covariates.

(3)-(4) Annual work hours of tertiary education group are assumed to depend on regional population size. Size of association between work hours and population is based on estimates for professionals reported in Rosenthal and Strange (2008a).

(5)-(6) Education groups face the same regional house prices.

(7)-(10) Prices of tradable goods are assumed to depend on regional population size. In (7)-(8) computed prices reflect transportation cost utilizing estimates from Hovi and Hansen (2010). In (9)-(10) prices are computed utilizing estimates from Handbury and Weinstein (2014).

(11)-(12) Prices of non-tradables are the same everywhere.

In the regression reported in the third column, we include both quality of life and productivity variables. Comparison with the first column shows that the coefficients of quality of life drops by approximately 40% but remain statistically significant for both secondary and tertiary education. The coefficients of productivity also drop but remain significant for both groups. Although we caution against drawing overly strong conclusions from this result, the estimates suggest that regional migration flows of persons with secondary or tertiary education may be driven both by quality of life and productivity considerations. The coefficient of quality of life for persons with primary education remains close to zero and statistically insignificant, thus indicating that quality of life is not an important determinant of migration flows for the low educated.

6.2. Robustness analyses

Table 10 presents alternative specifications of equations (1) and (3) in Table 9. In the first two columns of Table 10, education specific unemployment rates are included as explanatory variables, whereas in columns (3)-(12), dependent variables are the five alternative measures of quality of life presented in (3)-(7) in Table 4. We see that the results are very robust. The coefficients of quality of life change little across specifications and are always statistically significant for persons with secondary or tertiary education and never significant for persons with primary education.

7. Concluding remarks

In this paper, we use several data sets to evaluate the consumption hypothesis of geographical variation in educational attainment, i.e. that well-educated people particularly value the amenities that cities provide. Our results cast doubts on the plausibility of the hypothesis as we find only moderate preference differences between education groups. After-tax real wages are higher in rural areas than in urban areas, suggesting that Norwegians are willing to forego purchasing power in order to enjoy urban amenities, but the urban purchasing power premium is roughly equal across education groups.

As pointed out by Bayer et al. (2009), local wages and prices may not accurately reflect the marginal evaluation of amenities in the presence of migration costs. Since, in Norway, the well-educated move towards cities, it is possible that the urban gap in after-tax real wages underestimates the value of city life relative to life in rural areas for well-educated persons (the extra quality of life in cities must exceed the purchasing power premium plus migration costs for relocation to take place). And since persons without higher education move away from large regions in Norway, the urban gap in after-tax real wages may overestimate their evaluation of urban amenities relative to rural amenities.

If educational differences in preferences for city life are larger than suggested by the urban purchasing power premiums, we would expect the survey data to reveal substantial differences between education groups in evaluation of local amenities. But this we do not find. On the contrary, the survey data results point towards a broad consensus about the advantages and disadvantages of city-living. The education groups agree on whether a particular amenity is an urban amenity or an urban disamenity, the effects of population size on reported satisfaction with local amenities are quite similar across education groups, and the same area satisfaction indicators explain regional variation in purchasing power.

Net migration flows of persons with tertiary education are larger than those of persons with less educational attainment, and whereas the highly educated move towards areas with higher quality of life, net migration flows of persons without secondary education are unrelated to quality of life. Since education groups have roughly similar evaluations of amenities, but very different migration behavior, disparities in migration costs should receive more attention as a potential determinant of geographic variations in education attainment.

8. Acknowledgements

We thank Giorgio Fazio, David Albouy and colleagues at Department of Economics for useful comments. We are also grateful for comments from seminar participants at Norwegian University of Science and Technology, the 59th North American Meeting of the Regional Science Association International (RSAI 2012), and the 52nd Annual Meeting of the Western Regional Science Association (WRSA 2013).

References

Adamson, D., Clark, D., Partridge, M., 2004. Do urban agglomeration effects and household amenities have a skill bias? Journal of Regional Science 44, 201–223.

Albouy, D., 2009. The unequal geographic burden of federal taxation. Journal of Political Economy 117, 635–667.

Albouy, D., 2012. Are big cities bad places to live? Estimating quality of life across metropolitan areas. Working Paper, University of Michigan.

Bacolod, M., Blum, B., Strange, W., 2009. Skills in the city. Journal of Urban Economics 65, 136–153.

Bago d'Uva, T., Doorslaer, M., Lindeboom, M., O'Donnell, O., 2008a. Does reporting heterogeneity bias the measurement of health disparities? Health Economics 17, 351–375.

Bago d'Uva, T., O'Donnell, O., van Doorslaer, E., 2008b. Differential health reporting by education level and its impact on the measurement of health inequalities among older Europeans. International Journal of Epidemiology 37, 1375–1383.

Bayer, P., Keohane, N., Timmens, C., 2009. Migration and hedonic valuation: The case of air quality. Journal of Environmental Economics and Management 58, 1–14.

Black, D., Kolesnikova, N., Taylor, L., 2009. Earnings functions when wages and prices vary by location. Journal of Labor Economics 27, 21–47.

Brueckner, J., Thisse, J., Zelou, Y., 1999. Why is Central Paris rich and Downtown Detroit poor? European Economic Review 43, 91–107.

Carlsen, F., Johansen, K., 2004. Subjective measures of employment opportunities and interregional migration. Labour 18, 563–589.

Chen, Y., Rosenthal, S., 2008. Local amenities and life-cycle migration: Do people move for jobs or fun? Journal of Urban Economics 64, 519–537.

Combes, P.-P., Duranton, G., Gobillon, L., 2008. Spatial wage disparities: Sorting matters! Journal of Urban Economics 63, 723–742.

Combes, P.-P., Duranton, G., Gobillon, L., Roux, S., 2010. Estimating agglomeration economies with history, geology, and worker effects. In: Glaeser, E. L. (Ed.), Agglomeration Economics. The University of Chicago Press, pp. 15–66.

Dalmazzo, A., de Blasio, G., 2011. Amenities and skill-based agglomeration effects: Some results on Italian cities. Papers in Regional Science 90, 503–528.

Diamond, R., 2013. The determinants and welfare implications of US workers' diverging location choices by skill 1980-2000. Working Paper, Harvard University.

Diener, E., Lucas, R., 1999. Personality and subjective well-being. In: Kahneman, D., Diener, E., Schwarz, N. (Eds.), Well-being: Foundations of hedonic psychology. Russel Sage Foundation, New York, pp. 213–229.

Etzo, I., 2008. Internal migration: A review of the literature. Working Paper, University of Cagliari.

Florida, R., 2002. The economic geography of talent. Annals of the Association of American Geographers 94, 743–755.

Gabriel, S., Rosenthal, S., 2004. Quality of the business environment versus quality of life: Do firms and households like the same cities? Review of Economics and Statistics 86, 438–444.

Glaeser, E., 1999. Learning in cities. Journal of Urban Economics 46, 254–277.

Glaeser, E., Kolko, J., Saiz, A., 2001. Consumer city. Journal of Economic Geography 1, 27–50.

Glaeser, E., Maré, D., 2001. Cities and skills. Journal of Labor Economics 12, 216–342.

Glaeser, E., Resseger, M., 2010. The complementarity between cities and skills. Journal of Regional Science 50, 221–244.

Gould, E., 2007. Cities, workers, and wages: A structural analysis of the urban wage premium. Review of Economic Studies 74, 477–506.

Handbury, J., Weinstein, D., 2014. Goods prices and availability in cities. Review of Economic Studies, forthcoming.

Hansen, J., Formby, J., Smith, W., 1996. The income elasticity of demand for housing: Evidence from concentration curves. Journal of Urban Economics 39, 173–192.

Hansen, J., Formby, J., Smith, W., 1998. Estimating the income elasticity of demand for housing: A comparision of traditional and Lorenz-concentration curve methodologies. Journal of Housing Economics 7, 328–342.

Hovi, I., Hansen, W., 2010. Logistikkostnader i norske vareleverende bedrifter (Logistics costs of Norwegian firms that produce goods). Institute of Transport Economics, Oslo.

Johnston, D., Propper, C., Shields, M., 2009. Comparing subjective and objective measures of health: Evidence from hypertension for the income/health gradient. Journal of Health Economics 28, 540–552.

Jokela, M., 2009. Personality predicts migration within and between U.S. states. Journal of Research in Personality 43, 79–83.

King, G., Murray, C., Salomon, J., Tandon, A., 2004. Enhancing the validity and cross-cultural comparability of measurement in survey research. American Political Science Review 98, 191–207.

Lee, S., 2010. Ability sorting and consumer city. Journal of Urban Economics 68, 20–33.

Lindeboom, M., van Doorslaer, E., 2004. Cut point shifts and index shift in self-reported health. Journal of Health Economics 23, 1083–1099.

Machin, S., Salvanes, K., Pelkonen, P., 2012. Education and mobility. Journal of European Economic Association 10, 417–450.

Mayo, S., 1981. Theory and estimation in the economics of housing demand. Journal of Urban Economics 10, 95–116.

Mion, G., Naticchioni, P., 2009. The spatial sorting and matching of skills and firms. Canadian Journal of Economics 42, 28–55.

NOU, 2008. Distribution of revenues between regional health trusts (In Norwegian). NOU 2008:2, Oslo.

Rentfrow, P., Gossling, S., Potter, J., 2008. A theory of the emergence, persistence, and expression of geographic variation in psychological characteristics. Perspectives on Psychological Science 3, 339–369.

Roback, J., 1982. Wages, rents, and the quality of life. Journal of Political Economy 90, 1257–1278.

Røed Larsen, E., 2002. Searching for basic consumption patterns. Is the Engel elasticity of housing unity? Discussion Paper 323, Statistics Norway.

Røed Larsen, E., 2014. The Engel curve of owner-occupied housing consumption. Journal of Applied Economics 17, 325–352.

Rosenthal, S., Strange, W., 2008a. Agglomeration and hours worked. Review of Economics and Statistics 90, 105–118.

Rosenthal, S., Strange, W., 2008b. The attenuation of human capital spillovers. Journal of Urban Economics 64, 373–389.

Statistics Norway, 2012.
URL `www.ssb.no/befolkning/statistikker/fobsysut/hvert-10-aar`

Ulubasoglu, M., Cardak, B., 2007. International comparisons of rural-urban educational attainment: Data and determinants. European Economic Review 51, 1828–1857.

Valentinyi, A., Herrendorf, B., 2008. Measuring factor income shares at the sectoral level. Review of Economic Dynamics 11, 820–835.