Estimating Preferences for Local Public Services using Migration Data*

By

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September 2008

Abstract

Using unique Swedish micro data we examine the impact of local public services on community choice. The choice of community is modeled as a choice between a discrete set of alternatives. The US literature has produced conflicting evidence with respect to the importance of local public services. We find that, given taxes, high spending in child care and in other expenditures attract migrants. We obtain less conclusive results with respect to the role of spending in education and elderly care. High local taxes deter migrants. Relaxing the independence of irrelevant alternatives hypothesis by using the mixed logit model has a significant impact on the results.

Keywords: Migration, local public services, Tiebout, discrete choice, mixed logit
JEL classification: D12, H31, H73, R23

* We thank Per-Anders Edin, Eva Mörk and seminar participants at Uppsala University and IFAU) for useful comments. Jofre-Monseny acknowledges financial support from SEJ2007-65086/ECON

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1. Introduction

Since there is no market for local public services, it is not obvious how to estimate preferences for these services. In the literature, there exist several approaches to this problem. These include the median voter model (e.g., Bergstrom and Goodman, 1973), survey data approaches (e.g., Bergstrom *et al*., 1982), hedonic price models (e.g., Rosen and Fullerton, 1977), and discrete choice approaches.

Applications of the discrete choice approach are few in number: Friedman (1981), Quigley (1985), Rapaport (1997)[1], Nechyba and Strauss (1998) and Bayoh *et al.* (2006) are the only studies we know of[2]. These studies, all of them using U.S. data, arrive at conflicting conclusions with respect to the impact of local public services on household community choice. Quigley (1985) and Rapaport (1997) find negative effects. Friedman (1981) finds positive but small effects. Nechyba and Strauss (1998) and Bayoh *et al.* (2006) find positive and large effects. However, these studies differ in important respects such as sample size, type of households being analyzed (stayers *vs.* movers), geographic area and definition of the communities considered and the econometric specification. These differences that are summarized in Figure 1 are likely to drive the divergence in the results – at least to some extent.

[1] The effect of local public services on community choice is not the main object of interest in Rapaport (1997). The community choice equation is used to correct for the selection bias that the choice of community introduces in the estimation of housing demand equations.

[2] A related study is Schmidheiny (2006) that uses discrete choice models to investigate the role of local income tax rates on residential choices, using data on movers from the metropolitan area of Basel, Switzerland. He finds that high taxes deter migrants (especially the rich). The paper concludes that decentralized and progressive income taxation increases spatial income segregation.

Figure 1. Discrete choice approaches to study local public services valuation.

Feature\Study	Friedman (1981)	Quigley (1985)	Rapaport (1997)	Nechyba and Strauss (1998)	Bayoh *et al.* (2006)
# Decision makers	682	584	10,484	22,739	824
Definition of Decision maker	White families working in central city (stayers)	Renter households that moved within last year (movers)	Owner and renter households (stayers)	Owner hoseholds (stayers)	Owner households that moved within last year (movers)
# Communities	9	-.-*	5	6	17
Definition of Communities	Communities in San Francisco bay area, California	Dwellings, neighborhoods and towns in Pittsburg, Pennsylvania	School Districts (= Counties) in Tampa Bay, Florida	School Districts in Camden city, New Jersey	School Districts in Columbus County, Ohio
Econometric Method	Conditional logit	Nested logit (IIA holds at the town level)	Hybrid conditional logit**	Conditional logit + Polytomous model***	Hybrid conditional logit
Effects of Local Public Services	Positive but small	Negative	No effects	Positive and large	Positive and large

*For every household in the sample, the choice of town is analyzed by studying the location probability between the chosen town and one rejected town which is randomly selected by the researcher. ** Conditional logit with alternative-invariant regressors ***The model which Nechyba and Strauss (1998) refer to as a Polytomous model is an Hybrid conditional logit.

The purpose of this paper is to reexamine the question of the importance of local public services for community choice using Swedish data for movers within the local labor market of Stockholm. Swedish data are very suitable for the purposes of this paper. First, the quality of the data is exceptional. Second, local governments comprise a sizable fraction of aggregate economic activity in Sweden: in 1992, local government expenditure amounted to around 27 percent of GDP; by comparison, expenditures at the federal and local level in the US amounted to 15 percent (OECD, 1994)[3]. Third, local governments have important responsibilities such as the provision of day care, education, elderly care, and social welfare services. Finally, local governments have a large degree of autonomy regarding spending, taxing, and borrowing decisions. On the methodological side, we add to this literature by using an improved estimation strategy. In particular, we use the mixed logit model that relaxes the independence of irrelevant alternatives (IIA)

[3] In 1992, the share of local expenditures in total public expenditures was approximately the same (around 42 %) in Sweden and the US.

assumption which is inherent in the conditional logit model[4]. The mixed logit model has become the most promising state of the art technique in discrete choice models (Hensher and Greene, 2003) but has never been applied to study the impact of local public services on residential choice.

It is an open question whether one should use the stock of residents or recent movers to estimate the demand for local public services. Sizable adjustment costs suggests that stayers may be off their demand curve. Migrants, on the other hand, may have preferences that are not necessarily representative for the population. Greenwood *et al.* (1991) show that the equilibrium assumption inherent in using the stock of residents may result in the underestimation of the value of local amenities such as public services. So, in this paper we focus on movers since if there is a significant relationship between local public services and community choice we are most likely to find it in this category.

We do, however, consider different categories of movers. In particular, we differentiate between individuals who have moved long-distance, defined as a move across local labor markets, and those who have moved short-distance, defined as a move within the local labor market of Stockholm. In this study we will use short-distance movers since it turned out that the model under study suited that group better than the group of long-distance movers (see Dahlberg and Fredriksson, 2001). Long-distance movers presumably move for very different reasons and may lack the information necessary to optimize with respect to local amenities.

We have access to a unique individual data set – LINDA; see Edin and Fredriksson (2000). LINDA contains the characteristics of a large panel of individuals and is representative for the Swedish population. From these data we have selected all individuals who moved to a new municipality within the local labor market of Stockholm between 1990 and 1991. To these data we match a set of (destination) characteristics of the local public sector and other characteristics of the municipality, such as housing.

For each of the three main responsibilities of local governments in Sweden: Child care, education and elderly care, we construct a measure of spending per potential user. The rest of expenditures (culture, parks and recreation, high-school education,

[4] By mixed logit we refer to a conditional logit model with random parameters. The term 'mixed logit' has also been used to denote a conditional logit model that includes alternative-inavariant regressors.

administration, and assistance programs such as social assistance (welfare) and housing assistance are aggregated into an other expenditures item which is measured in per capita terms. We estimate the impact of these local public services on the residential choices of short distance movers holding local taxes fixed.

Our results can briefly be summarized as follows. We find that, given taxes, high spending in child care and in other expenditures attract migrants. We obtain less conclusive results with respect to the role of spending in education and elderly care. High local taxes deter migrants. Relaxing the IIA assumption by means of using the mixed logit model has a significant impact on the results one obtains regarding the demand for local public services.

The remainder of the paper is organized as follows. In the next section we present the econometric framework. Section 3 presents the econometric methods to be used in the paper. In Section 4 we describe the data more thoroughly. Section 5 presents the results and Section 6 offers concluding remarks.

2. Theoretical framework

In this section we present the problem facing an individual deciding in which community to reside.

Consider an individual who is confronted with a discrete set of location alternatives (communities) within a local labor market. When maximizing over this discrete set of alternatives she takes the attributes of the communities into consideration. In the spirit of Tiebout (1956), we mainly have local public services in mind when characterizing the attributes of the community (c). The public services we consider are: Child care (ch_c), education (ed_c), elderly care (ec_c) and other expenditures (o_c). We assume that the choice of local labor market has been made in a prior stage. Also, we take housing tenure and size choices as given[5].

The individual, i, has additively separable preferences over the consumption of public goods and private goods[6], x_{ic} (housing consumption is subsumed into x_{ic}). We assume that the utility function is given by

[5] Dahlberg and Fredriksson (2001) report some evidence on the latter assumption. It turns out that less restrictive assumptions regarding housing choices yield only minor changes of the results.
[6] The local public services we are looking at are, strictly speaking, publicly provided private goods.

$$u_{ic} = a_c + z(x_{ic}) + m(ch_c, ed_c, e_c, o_c) + \varepsilon_{ic} \tag{1}$$

where a_c denotes community amenities distinct from local public services. The random component of (1), ε_{ic}, captures random preferences for the (*c*)th alternative. The individual budget constraint takes the form

$$y_i(1 - \tau_c) = \rho_c x_{ic} \tag{2}$$

where y_i denotes income, ρ_c the price of private goods, and τ_c the local income tax rate. Thus, local public services are financed by income taxes[7].

For estimation purposes, we assume that the function $z(\cdot)$ and $m(\cdot)$ in (1) are logarithmic. We further assume that $m(ch_c, ed_c, e_c, o_c) = \ln(ch_c^{\beta_3} ed_c^{\beta_4} e_c^{\beta_5} o_c^{\beta_6})$. So a stylized version of utility would be[8]

$$u_{ic} = \beta_o \ln y_i + \beta_1 \ln(1 - \tau_c) + \beta_2 \ln \rho_c + \beta_3 \ln ch_c + \beta_4 \ln ed_c + \beta_5 \ln e_c + \beta_6 \ln o_c + \varepsilon_{ic} \tag{3}$$

We also assume that y_i is determined by choice of local labor market. Since we consider choice of community conditional on choice of local labor market, y_i does not vary by *c* and can hence be ignored. The utility actually observed is the maximum over the set of all possibilities and (in principle) the coefficients have the interpretation of marginal utilities[9].

3. Econometrics

Let us rewrite (3) in general form

$$U_{ic} = x'_{ic}\beta + \varepsilon_{ic} \tag{4}$$

Given that the utility observed is the maximum over the set of alternatives and ε_{ic} is i.i.d. with the type I extreme value distribution, McFadden (1973) has shown that the probability that individual *i* chooses community *c* is given by

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[7] In Sweden, 99.6 % of the taxes raised at the municipal level come from income taxation. Moreover, the local tax rate is proportional so there is not much abuse of reality in specifying the left-hand side of (2).
[8] In the empirical exercise we allow some of the β's to be individual specific.
[9] The simple model outlined here of course implies the restriction $\beta_1 = -\beta_2$. Given that we only have approximate measures of local prices, we choose to enter prices and taxes freely throughout.

$$\Pr(i \text{ chooses } c) = \frac{\exp(x_{ic}'\beta)}{\sum_{c} \exp(x_{ic}'\beta)} \tag{5}$$

Equation (4) implies that the odds ratio between two alternatives does not change by the inclusion or exclusion of any other alternative. This is a property that has been labelled the "independence of irrelevant alternatives" (the IIA-property) and follows from the independence of ε_{ic}. It is an unfortunate property because it yields unrealistic substitution patterns. For instance, a ten percent reduction in one alternative implies a ten percent reduction in each other alternative.

The mixed logit model provides a simple generalization of the conditional logit model that relaxes the IIA assumption. The mixed logit model specifies the parameters to be individual specific by assuming that they follow a random distribution, i.e.

$$U_{ic} = x_{ic}'\beta_i + \varepsilon_{ic} \tag{6}$$

where $\beta_i = \beta + \eta_i$ and $\eta_i \sim \mathrm{N}(0, \Omega_\beta)$[10]. This means that (6) can be written as $U_{ic} = x_{ic}'\beta + \upsilon_{ic} + \varepsilon_{ic}$ where $\upsilon_{ic} \equiv x_{ic}' \cdot \eta_i$ is an error component that induces correlation across alternatives (in particular, $\mathrm{cov}(\upsilon_{ic}, \upsilon_{ir}) = x_{ic}'\, \Omega_\beta\, x_{ir}$). At an intuitive level, individuals that prefer the x's of one community will tend to switch to communities with similar x's. Thus, different patterns of correlation, and hence different substitution patterns, can be obtained through different specifications of Ω_β.

There is another reason that justifies the use of the mixed logit model, aside from producing more realistic substitution patterns. In non-linear models, unlike linear models, estimators that fail to control for the randomness of the parameters yield inconsistent estimates of the mean effects (Cameron and Trivedi, 2005). Hence, conditional and mixed logit models need not give similar estimates of the parameter means.

[10] The commonest practice in the literature is to assume normality and to set the off-diagonal elements of Ω_β to zero. We make these assumptions throughout the paper.

4 Data

We use two categories of data in this study: (*i*) data on the characteristics of individual migrants; and (*ii*) data on the attributes of the communities. We describe these data in turn, beginning with migrants.

4.1 The characteristics of migrants

Individual data on migrants come from the data base LINDA; see Edin and Fredriksson (2000). LINDA is a large panel of individuals, which is representative for the Swedish population; it covers around 3 percent of the population. The information in LINDA primarily comes from two data sources: filed tax reports and population censuses.

From LINDA we extract those 20-65 year olds that moved to a different municipality between 1990 and 1991 and where the destination municipality was located in the Stockholm labor market. Altogether there were 2,018 such moves; 1,444 moved to another municipality within Stockholm (our definition of a short-distance move) and 574 entered from another local labor market (our definition of a long-distance move). In this study we will use short-distance movers since it turned out that the model under study suited that group better than the group of long-distance movers (see Dahlberg and Fredriksson, 2001).

Table 1 presents descriptive statistics for three categories of individuals; the first column gives the means and (where appropriate) the standard deviations for short-distance movers and, for comparative reasons, the second column presents descriptive statistics for long-distance movers and the last column gives the means and standard deviations for those individuals who did not move at all.

Table 1. Descriptive statistics: movers and stayers.

	Short-distance movers Mean (std.)	Long-distance movers mean (std.)	Stayers mean (std.)
Individual characteristics			
Female	.458	.498	.504
Age	31.6 (10.1)	30.1 (9.5)	40.9 (12.0)
Immigrant	.188	.206	.198
Post high school education	.294	.321	.283
Earnings (SEK 100)	1,418 (941)	1,000 (862)	1,501 (1,050)
Employed	.891	.760	.870
Unemployed	.026	.111	.020
Welfare recipient	.055	.145	.044
Subsequent mobility	.369	.466	.174
Household characteristics			
Size of household	1.44 (.90)	1.33 (.86)	1.99 (1.18)
Kids ≤ 15 years of age	.184	.167	.294
Household earnings (SEK 100)	1,760 (1,335)	1,200 (1,202)	2,335 (1,724)
House ownership	.253	.340	.369
Employed family members	.191	.108	.440
# individuals	1,444	574	27,121

Notes: Except for subsequent mobility, all characteristics refer to 1990. Employed = 1 if individual earnings were greater than one basic amount. Unemployed = 1 if the individual received UI or Cash Assistance during 1990. Welfare recipient = 1 if the individual received welfare during 1990. Subsequent mobility =1 if the individual moved again between 1991 and 1997. Households are defined for tax purposes, i.e., married individuals and cohabiting individuals who have children in common are defined as a household. Employed family members = 1 if there were employed family members in the household according to the above definition. Individuals who did not move house between 1990 and 1991 are defined as stayers.

Migrants in general tend to be younger than stayers. Moreover, they are members of smaller households. The previous labor market history is strikingly different for long-distance movers compared to short-distance movers and stayers. Long-distance movers earned 40-50 percent less than the other two categories; their employment rates were 11-13 percentage points lower; and welfare receipt was substantially more prevalent. This suggests, of course, that long-distance movers primarily entered Stockholm for labor market reasons. Previous work has shown that these two groups exhibit different behavior with respect to out-migration; see Westerlund and Wyzan (1995) and Widerstedt (1998) for work on Swedish data. In a similar vein, we note that long-distance movers are more likely to move again within six years after their original move. In sum, it is probably reasonable to estimate separate locational choice equations for long- and short-distance movers.

4.2 Municipal characteristics

Table 2 presents summary statistics for the municipalities in the sample. The data has been obtained from Statistics Sweden. To avoid simultaneity problems we use 1990

characteristics throughout. We use expenditure data to proxy for the quality of local public services. This is of course unfortunate, but data reflecting the quality of services is very seldom available. In fact, we know of no study where community choice has been related to the *quality* of public services.

Average total expenditure amounts to over 1,500 Million SEK, which corresponds to 165 Million PPP-adjusted US$ in 1990. Hence, by international standards the Swedish local public sector is large. The prime responsibilities of the municipalities are schooling and care for children and the elderly. Expenditures on child and elderly care include labor costs, rents, and administration costs. With respect to education expenditure, however, we are able to exclude rents and administration costs so that this item only includes expenditures related to teaching. Panel A of Table 2 shows that, on average, 13 percent of expenditure is devoted to teaching at the compulsory level and 32 percent is devoted to child and elderly care. The remainder of the local budget (55 percent on average) is allocated to culture, parks and recreation, high-school education, administration, and assistance programs such as social assistance (welfare) and housing assistance[11].

Panel B of Table 2 presents local variables as we introduce them in the empirical analysis (although we enter some variables in logs). Our general strategy is to measure each expenditure item per potential user. Child care expenditure is measured relative to the size of the population aged 0-6, education relative to the size of population aged 7-15 and elderly care relative to the size of population aged 65 or more. The item other expenditures is measured relative to the population. For estimation purposes, we note that there is a fair amount of variation in local expenditure. The coefficient of variation for the expenditure items ranges from 9 to 19 percent.

[11] Ideally, we would have liked to separate expenditures on high-school education from those included in other expenditures. However, 5 out of the 22 municipalities for which we have disaggregate school expenditure data do not provide high school education; instead they buy these services from neighboring municipalities.

Table 2: Descriptive statistics, municipalities.

	Mean (std.)
A. Expenditure	
Total	1,541,007 (3,454,629)
Percent of total expenditure devoted to…	
…child care	24
…education (expenditures on teaching at compulsory level)	13
…elderly care	8
…other purposes	55
B. Variables relevant for the empirical analysis	
Child care (per individual aged 0-6)	56.188 (9.265)
Education (expenditures on teaching, per individual aged 7-15)	23.921 (2.266)
Elderly care (per individual aged 65--)	16.290 (3.136)
Other purposes (per capita)	12.226 (2.259)
Municipal tax rates (percent)	14.73 (1.24)
Social assistance (norm 1)	111.69 (7.50)
Social assistance (norm 2)	185.77 (9.66)
House price	1291.115 (447.741)
Vacant rentals	8.73 (23.61)
Population size	63,256 (125,843)
Share of foreign citizens (percent)	8.88 (3.84)
Municipal unemployment (percent of population age 18-65)	0.60 (0.20)
# Municipalities	26

Notes: Expenditures and house prices are expressed in thousands of SEK. The house price used is the average price of houses sold in a municipality in 1990. Social assistance (norm 1) is the municipality norm for single-person households (in percent of the basic amount). Social assistance (norm 2) is the municipality norm for married or cohabiting persons (in percent of the basic amount). Since we know the marital status of the households in our data, we can attach the appropriate social norm to each of the observations. This is what we have done for the variable "social assistance", which is the variable we use in the estimations. Expenditures on teaching at compulsory level had to be imputed for four municipalities. The imputation procedure is described in Appendix A.1.

The bottom half of panel B reports some other characteristics that we will condition on in the empirical analysis. These characteristics include welfare generosity, some information pertaining to the housing market, population characteristics, and unemployment rates.

Municipalities are free to determine the generosity of social assistance (welfare); the Swedish system is thus similar to the American system in this respect. We report two measures of welfare generosity. The first measure (norm 1) pertains to singles, while the second (norm 2) pertains to married or cohabiting couples. A feature of our data is that we know the marital status of each person in our sample[12]. Hence, we can assign the norm that is of relevance for the particular individual, yielding local and individual variation in welfare generosity. This is the approach we take during estimation and we normalize the norm by the number of adult members of the household.

[12] Notice, though, that households are defined for tax purposes, meaning that cohabiting individuals who have children in common are classified as households (together with married individuals). Thus the number of cohabiting individuals is underreported in our sample.

The characteristics of the housing market are summarized by the average price on sold houses during 1990 and the number of vacant rental apartments in September of 1990. The three major tenure forms in the Swedish housing market are owner occupancy, condominiums (coop shares), and renting. These tenure forms accounted for 22, 17, and 47 percent, respectively, of the total number of apartments in the Stockholm area in 1990. The Swedish housing market is far from the idealized competitive one. This is particularly true for the rental market, where there are price restrictions and rationing rather than prices being determined by supply and demand. Thus, attractive areas feature longer queues rather than higher rents; in principle, there should be no price differences for dwellings of equal size and quality across the country. To capture the fact that the rental market exhibits rationing we use the number of vacant public rentals in the regressions. The number of vacancies was extremely low because of the booming housing market in 1990.

The bulk of regional price variation within the Stockholm area is due to house prices. Market forces essentially determine the prices of non-rental housing. However, there is only price information pertaining to owner-occupancy, which is directly relevant for only 22 percent of the market. Even if we make the assumption that the prices of "coops" are proportional to the prices of owner-occupied housing there is still 47 percent of the market where the price information is of limited relevance.

Given that we hold *all* regional amenities constant, we would like to think about higher house prices as a deterrent to entry. However, the assumption that we measure *all* regional amenities is not particularly realistic. Hence, the sign of house prices is ambiguous if there is some capitalization of amenities into prices (see e.g. Yinger, 1982, on the idea that local public services and taxes will be capitalized fully into house prices). Although the interpretation of the house price variable is problematic, capitalization has the virtue that there is less risk of misspecification in the sense that any relevant variable that we leave out of the model will to some extent be included if we control for house prices.

We consider two measures to control for population characteristics: population size and the share of foreign citizens. The municipalities of the Stockholm labor market vary substantially in size. The extreme case is the Stockholm municipality, which is 100 times

larger than the smallest municipality (Vaxholm) and eight times greater than the second largest one. Thus, the largest share of the inflow will enter the Stockholm municipality by construction. To avoid these "mechanical" effects we control for population size throughout.

According to Table 1, around 20 percent of movers are foreign-born. In the literature on immigrants' internal migration, it has been shown that they are attracted to localities with large fractions of foreigners; see, e.g., Zavodny's (1999) survey of the US studies and Åslund (2004) on Swedish data. Therefore, it is potentially important to control for immigrant concentration. In general, of course, immigrant concentration may represent an attracting force for some and a repelling force for others.

The last regional characteristic that we consider is local unemployment. The unemployment to population ratio in Stockholm is extremely low in 1990. A long economic upturn starting in the beginning of the 1980s peaked around 1990; the aggregate unemployment to population ratio stood at 1.4 percent in 1990. If Stockholm truly is one single local labor market, then labor market prospects as such should not matter for community choice. However, it may still be the case that agents dislike (or like, depending on individual characteristics) living in unemployment-ridden communities.

5. Results

Having described the data, we now turn to the estimation results. In this section we ask questions such as: How important are local public services for choice of community? Does the importance vary across different categories of individuals?

5.1 Determinants of community choice: Baseline estimates

We first focus on the effects of community characteristics on the location decisions of migrants. The estimates are presented in Table 3. In column I, we report conditional logit estimates. In column II, we present mixed logit estimates where we specify the parameters capturing the effect of local public services and the tax retention rate to be random. The estimated standard deviations of these random parameters are reported at the bottom part of Table 3. A likelihood ratio test soundly rejects the hypothesis that all

parameters are fixed. The estimates reported in column II, indicate that there seems to be preference heterogeneity only in child care and in other purposes expenditures. In column III we report the estimates when we constrain the parameter of the tax retention rate to be fixed. In column IV, we further assume that the coefficients of education and elderly care are fixed. Noting that the results do not undergo any significant change, we discuss mixed logit results on the basis of this last, more parsimonious, specification.

Given expenditure per capita, both the conditional and the mixed logit estimates indicate that low taxes attract movers. In contrast, these two models lead to different conclusions regarding the qualitative effects of some expenditure categories. Given taxes, expenditure in child care seems to attract migrants in the mixed logit specification (but not in the conditional logit) whereas high spending in education seems to attract migrants in the conditional logit specification (but not in the mixed logit).

It is particularly striking that the coefficient capturing the effect of child care spending on utility is seven times larger in the mixed logit specification (mean effect) than it is in the conditional logit one. However, coefficients are not comparable across specifications since they are only identified up to a multiplicative scale. By focusing instead on ratios of coefficients we do away with this problem. In the stylized framework of section 2, the parameter ratio between a public service and the tax retention rate is related to the marginal rate of substitution between the public service and private goods (i.e. net income). According to mixed logit estimates, an individual with average taste for child care requires an income increase around 0.16 percent to compensate for a reduction of this public service of one percent. Note that the conditional logit estimates imply a compensating variation for child care of only 0.02. This suggests that, in our application, taking preference heterogeneity into account matters even when the interest lies in estimating mean effects. We will therefore focus on discussing mixed logit results.

Table 3. Conditional and mixed logit results for choice of municipality

Variables	I	II	III	IV
Expenditure (in logs)				
Child care	0.374 (0.333)	2.639 (0.669)***	2.639 (0.669)***	2.641 (0.672)***
Education	1.032 (0.465)**	0.637 (0.484)	0.637 (0.484)	0.637 (0.484)
Elderly care	0.312 (0.234)	0.137 (0.258)	0.137 (0.258)	0.135 (0.258)
Other purposes	1.150 (0.313)***	0.922 (0.332)***	0.922 (0.332)***	0.925 (0.333)***
"Prices" (in logs)				
Tax retention rate: (ln(1- τ))	17.855 (3.469)***	16.550 (3.688)***	16.550 (3.688)***	16.544 (3.688)***
House price: ln(ρ)	-0.205 (0.233)	-0.088 (0.262)	-0.088 (0.262)	-0.091 (0.262)
Other variables				
Population size ($\times 10^{-5}$)	0.349 (0.024)***	0.294 (0.027)***	0.294 (0.027)***	0.294 (0.027)***
Vacant rentals ($\times 10^{-2}$)	0.377 (0.135)***	0.532 (0.136)***	0.532 (0.136)***	0.532 (0.136)***
Social Assistance	-0.007 (0.007)	-0.017 (0.008)**	-0.017 (0.008)**	-0.017 (0.008)**
Share of foreign citizens	3.554 (1.441)***	5.974 (1.569)***	5.974 (1.569)***	5.967 (1.570)***
Local Unemployment	-94.434 (26.112)***	-119.892 (27.899)***	-119.892 (27.899)***	-119.916 (27.910)***
Error components				
Child care		4.765 (0.760)***	4.764 (0.760)***	4.762 (0.762)***
Education		0.002 (0.971)	0.002 (0.971)	
Elderly care		0.003 (0.478)	0.003 (0.478)	
Other purposes		2.337 (0.964)***	2.337 (0.964)***	2.348 (0.965)***
Tax retention rate: (ln(1- τ))		0.265 (7.182)		
Log-L	-4,019	-4,009	-4,009	-4,009
LR-Test Fixed *vs.* Random Parameters		20.68 [0.000]	20.68 [0.000]	20.68 [0.000]
# individuals	1,444	1,444	1,444	1,444

Notes: Standard errors in parenthesis. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level. . Mixed logit results (250 Halton Draws) are obtained with Stata command *mixlogit* written by Arne Risa Hole. A normal distribution is assumed for every parameter considered random.

The parameter capturing the effect of spending in education is positive but insignificant both in statistic and economic terms (the compensating variation is only 0.04). This is at odds with the US estimates provided by Nechyba and Strauss (1998) and Bayoh *et al.* (2006) that suggest a significant (economic) effect of education expenditures on household community choice. Of course, there might be several explanations for this – one obvious candidate is the difference in the underlying populations. However, we would also like to emphasize two of the institutional differences between Sweden and the US. First, the years we study feature a minimum school quality standard that was implemented by the central government via specific grants (the municipalities were free to improve on this standard by increasing education expenditure). Effectively, the binding minimum standard eliminates the lower tail of the school quality distribution and, given decreasing returns to school quality, the marginal utility of an increase in school expenditure may be lower than in a situation with no minimum standard[13]. Second, the Swedish school system is decidedly more egalitarian than the American one; see, e.g., Lindahl (2000). More resources are directed towards the less able in Sweden. Therefore, a given variation in education expenditure may be less related to variations in the quality of publicly provided education for the average individual.

It is not too surprising that we do not find evidence that high spending in elderly care attracts migrants since very few of them are close to become potential users. Note that only 100 out of 1,444 short-distance movers are over 50 years old. Hence, our data on migration can tell us little about the demand for elderly care.

Given taxes, high spending in the other purposes item attracts migrants. The (mean) coefficient is statistically significant at the 5 percent level. The compensating variation for an individual with an average taste for spending in this category is 0.06. It is difficult to put this number in context because of the very heterogeneous expenditures that comprise this category.

High house prices do not seem to deter individuals from entering a municipality. This result is broadly consistent with the idea that regional amenities capitalize into house

[13] Think of a world where parents have preferences defined over their own consumption and the consumption of their children. An increase in school expenditure raises the future consumption opportunities of children. The marginal utility of public education (for parents) will then be positively related to the return to an increase in public education.

prices[14]; however, it may also reflect the fact that we measure a price that is of limited relevance for a substantial fraction of the sample.

Most of the coefficients on the additional controls are in line with expectations: housing vacancies attract migrants, while poverty stricken areas, as measured by unemployment, deter migrants. Welfare generosity enters negatively, which is not too surprising, given that generous welfare benefits may represent incentives for some migrants and disincentives to others. What is more surprising, perhaps, is the fact that immigrant concentration enters positively and significant. This is due to the fact that the foreign-born constitutes close to 20 percent of the sample, and they value immigrant concentration positively[15].

The error component estimates indicate that there is a fair amount of heterogeneity in the weight that migrants put on child care and other purposes expenditures. The compensating variation for child care is normally distributed with mean 0.16 and standard deviation of 0.29[16]. This implies that about 25 percent of households put a negative value on spending in child care. This could reflect reality or could be the result of using a normal distribution to capture heterogeneity[17]. The compensating variation for other purposes spending yields a similar picture. In this case, the compensating variation is normally distributed with mean 0.06 and standard deviation of 0.14. We plot the distributions of the compensating variations for child care and other purposes expenditures in Figure 2.

[14] Suppose that local public services and taxes are the only regional amenities and that they are fully capitalized into house prices. Then all three coefficients are not simultaneously identified: either the coefficients on taxes and public expenditure or the coefficient on house prices would drop out of the equation.
[15] A simple interaction between immigrant status and the share of foreign citizens suggests that the positive coefficient is mostly driven by the foreign born; the coefficient for natives is positive but insignificant.
[16] The compensating variation has a normal distribution given that we assume that the tax retention rate parameter is fixed.
[17] One alternative to avoid negative valuations of public services would be to fit lognormal distributions for the parameters.

Figure 2a. Distribution of compensating variation for child care expenditure.

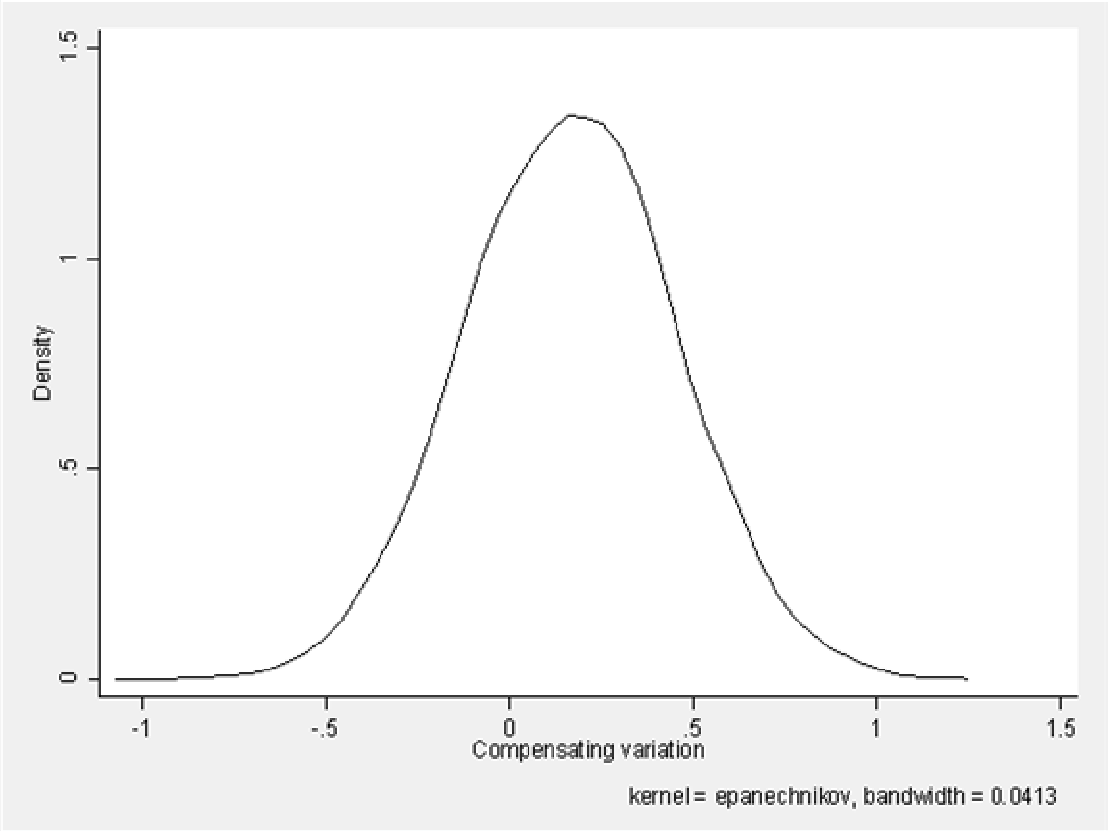
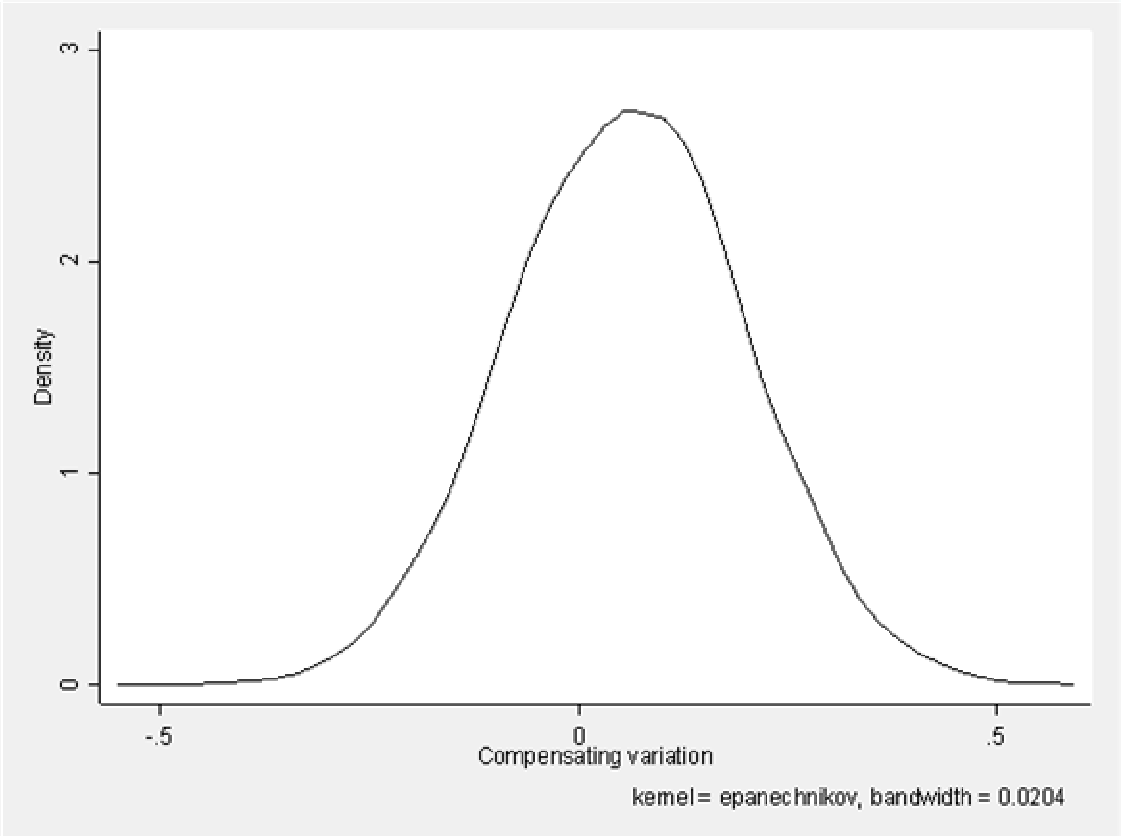


Figure 2b. Distribution of compensating variation for other purposes expenditure.



We now turn to a more policy oriented question, namely, how responsive are migrants to changes in public services spending. We focus here on the effect of changing spending in child care.

The first question we address is how many migrants a municipality attracts by increasing child care spending. To be more specific, we look at the effect of 9,265 extra SEK per pupil (1 standard deviation in levels) on the percentage increase in probability, i.e. $\Delta \Pr_{ic} / \Pr_{ic}$. In Figure 3a, we report the effects that are implied by mixed logit estimates (estimates in column IV in Table 3). The conditional logit counterparts (estimates in Column I in Table 3) are also shown for illustrative purposes.

Preference heterogeneity at the individual level seems to translate into response heterogeneity at the municipal level. The percentage increase in probability increases remarkably with the level of spending in this item. In fact, municipalities with the lowest expenditure levels in child care attract fewer households by increasing spending in this category. This can be explained by the fact that migrants that choose municipalities with low child care spending are those who value spending in this category the least (and they do so negatively). Instead, migrants that put a large weight on child care self-select into municipalities with high spending in this category. These municipalities can expect large responses since they compete for individuals that value child care intensively. Note that conditional logit estimates imply, instead, very similar effects across municipalities. From a policy perspective it would hence be quite misleading to rely on a conditional logit estimator.

Figure 3a. The effect of increasing spending in child care by 1 standard deviation in one municipality on the percentage change in the probability that individual *i* chooses that municipality

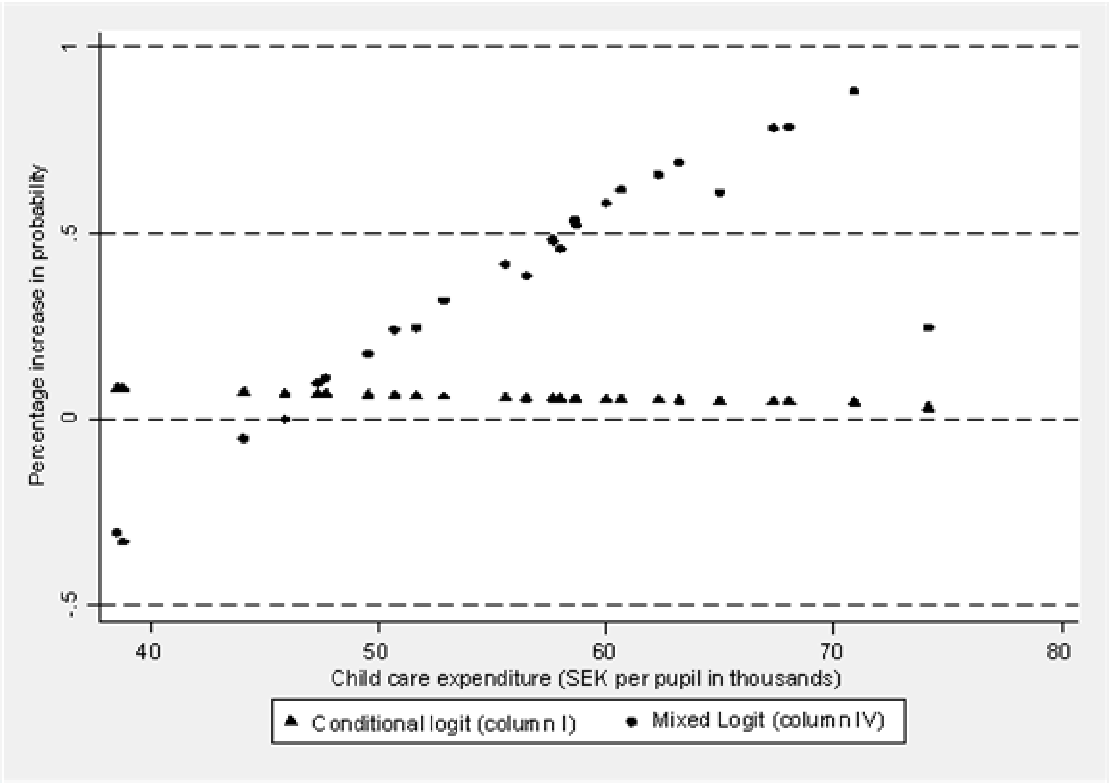
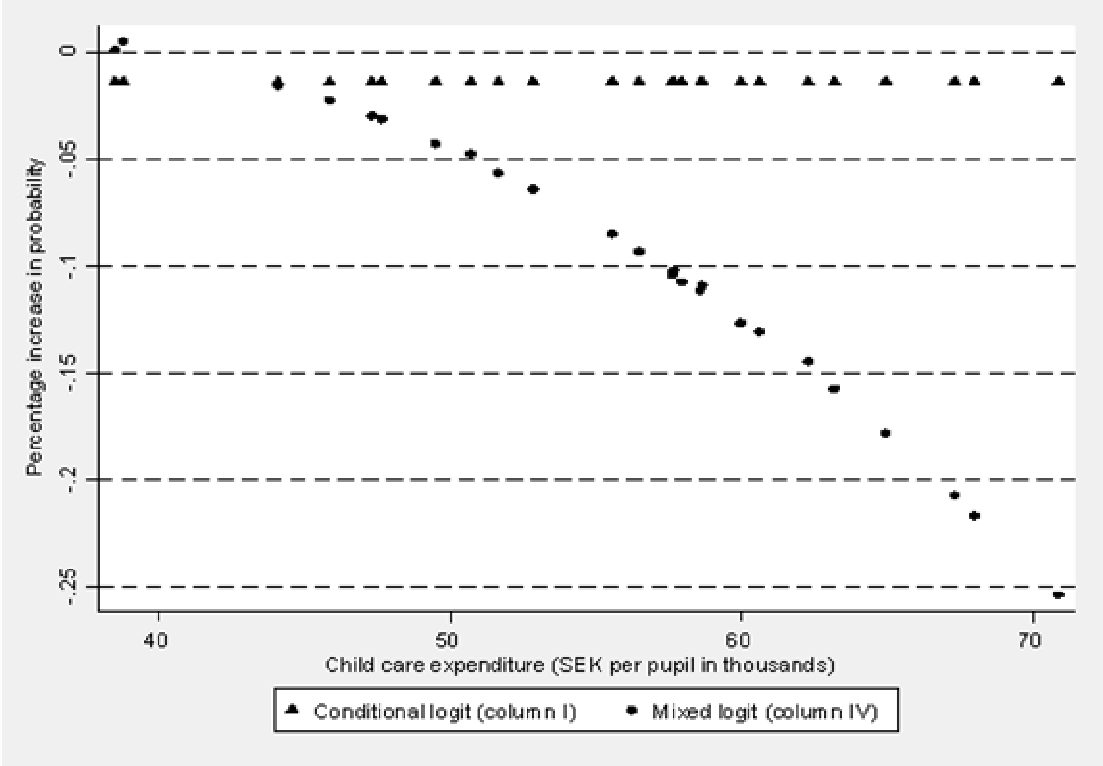


Figure 3b. The effect of Stockholm's municipality increasing child care spending by 1 standard deviation on the percentage change in the probability that individual *i* chooses another municipality.



The second question we address is how many migrants a municipality looses when another jurisdiction increases child care spending. In Figure 3b we illustrate the effect of 9,265 extra SEK per pupil (1 standard deviation in levels) in Stockholm's municipality on the percentage increase in probability for the rest of municipalities[18]. We present the effects implied by conditional logit estimates, too. Note that according to these, all municipalities experience exactly the same reduction in attracting migrants (in percentage terms). This follows from the IIA assumption and constitutes one of the main limitations of this model. Instead, mixed logit estimates imply higher effects for those municipalities that spend similarly to Stockholm (in this particular item). On the contrary, those municipalities that are the most dissimilar to Stockholm in terms of child care spending hardly experience any reduction in migrant inflows. This substitution pattern implied by mixed logit estimates suggests that a municipality should pay special attention to what similar neighbors are doing.

5.2 Determinants of community choice: Further evidence

The purpose of this subsection is to present some further evidence on the determinants of community choice. In particular we explore whether or not preferences vary by individual (observed) characteristics. We investigate the role of age and income (measured by earnings) in Table 4[19]. In column I, we interact age with all expenditure items and the tax retention rate. In column II, we do the same with income. In column III, we introduce age and income interactions simultaneously.

[18] We choose to illustrate the case of Stockholm because it is the municipality with the highest level of child care spending. A similar picture is obtained for the rest of municipalities.
[19] We have also tried interactions with other background characteristics. For instance, there was no significant difference between individuals who had children under the age of 16 and those who had not.

Table 4.- Mixed logit results for choice of municipality. Age and income interactions.

Variables	I Age	II Income	III Age & Income
Expenditure (in logs)			
Child care	2.498	2.635	2.499
	(0.663)****	(0.671)***	(0.663)***
Interaction: Child care×(age- $\overline{age}$)	-0.150		-0.151
	(0.028)***		(0.028)***
Interaction: Child care×(income- $\overline{income}$)		-0.263	0.077
		(0.305)	(0.305)
Education	0.697	0.654	0.714
	(0.487)	(0.484)	(0.487)
Interaction: Education×(age- $\overline{age}$)	0.082		0.092
	(0.041)**		(0.042)**
Interaction: Education×(income- $\overline{income}$)		-0.171	-0.381
		(0.400)	(0.415)
Elderly care	0.168	0.138	0.174
	(0.259)	(0.259)	(0.259)
Interaction: Elderly care×(age- $\overline{age}$)	-0.024		-0.024
	(0.017)		(0.018)
Interaction: Elderly care×(income- $\overline{income}$)		0.006	0.065
		(0.186)	(0.190)
Other purposes	0.915	0.947	0.928
	(0.334)***	(0.333)***	(0.334)***
Interaction: Other purposes×(age- $\overline{age}$)	0.000		0.007
	(0.021)		(0.021)
Interaction: Other purposes×(income- $\overline{income}$)		-0.386	-0.391
		(0.235)	(0.237)*
"Prices" (in logs)			
Tax retention rate: ($\ln(1-\tau)$)	16.203	16.200	15.979
	(3.715)***	(3.797)***	(3.729)***
Interaction: $\ln(1-\tau)$ ×(age- $\overline{age}$)	0.631		0.594
	(0.246)***		(0.254)**
Interaction: $\ln(1-\tau)$ ×(income- $\overline{income}$)		3.710	2.420
		(2.529)	(2.574)
House price: $\ln(\rho)$	-0.028	-0.080	-0.024
	(0.263)	(0.262)	(0.264)
Other variables			
Population size ($\times 10^{-5}$)	0.303	0.294	0.302
	(0.027)***	(0.027)***	(0.027)***
Vacant rentals ($\times 10^{-2}$)	0.532	0.538	0.535
	(0.136)***	(0.136)***	(0.136)***
Social Assistance	-0.018	-0.018	-0.018
	(0.007)**	(0.008)***	(0.008)***
Share of foreign citizens	5.931	5.866	5.846
	(1.575)***	(1.572)***	(1.577)***
Local Unemployment	-121.478	-119.499	-120.866
	(27.964)***	(27.931)***	(27.977)***
Error components			
Child care	4.519	4.519	4.522
	(0.760)***	(0.760)***	(0.760)***
Other purposes	2.209	2.209	2.231
	(0.981)**	(0.981)**	(0.978)**
Log-L	-3,988	-4,002	-3984,00
LR-Test Fixed *vs.* Random Parameters	18.21	20.67	18.22
	[0.00]	[0.00]	[0.00]
# individuals	1,444	1,444	1,444

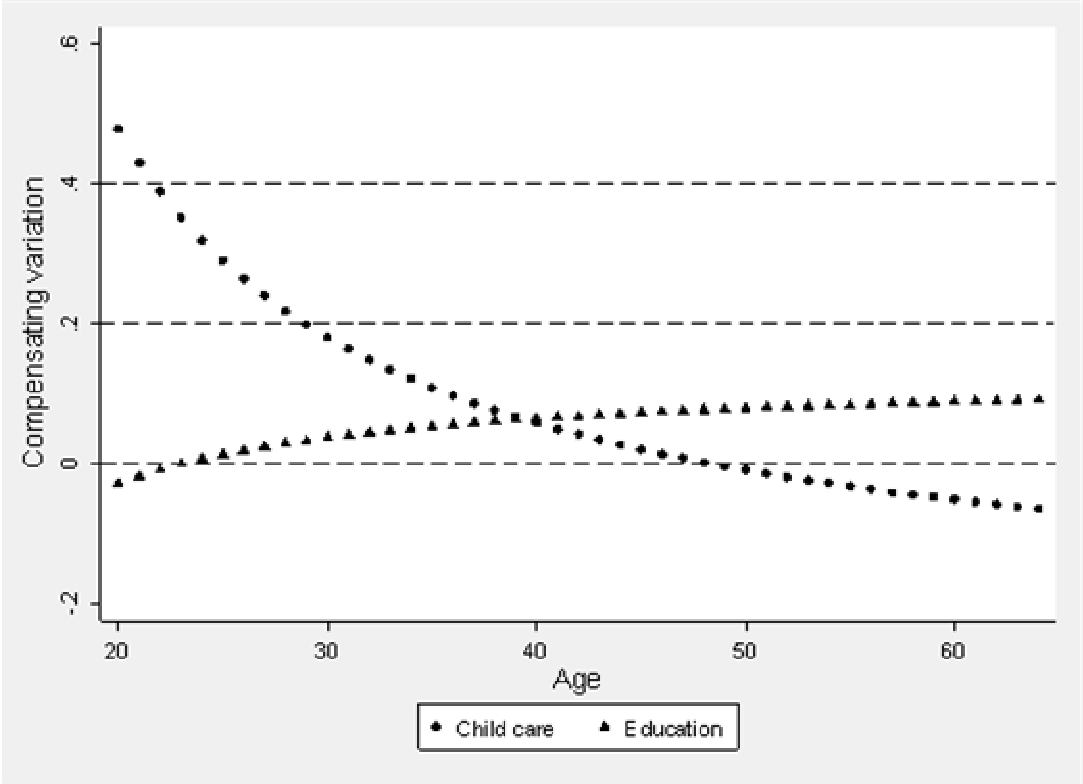
Notes: Income measured in thousand SEK. Standard errors in parenthesis. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level. Sample mean of income is 1.418 thousand SEK. Sample mean of age is 31.6 years. Mixed logit results (250 Halton Draws) are obtained with Stata command *mixlogit* written by Arne Risa Hole. A normal distribution is assumed for every parameter considered random.

According to estimates in Column I, the expenditure items with a significant age interaction are child care and education expenditure. Demand for child care declines with age, while demand for education increases with age. These patterns broadly conform to intuition. Comparatively young individuals are more likely to have children in kindergarten age and so value the increase in childcare expenditures more. Older individuals are more likely to have kids aged 7-15, and, hence, have a stronger preference for increases in school expenditure. Notice also that we have experimented with more flexible age interactions (we used a quadratic in age) without changing the overall flavor of the results.

In line with results reported in Table 3, the effect of education spending on utility is statistically insignificant for a mover with average age. However, the results in Table 4 indicate that some individuals, those with higher ages, do value expenditure in education. Note that mixed logit estimates in Table 3 fail to reproduce this heterogeneity in the parameter that captures the effect of education spending on utility.

According to results, the deterrent effect of high local taxes is increasing with the age of migrants. Perhaps, this could reflect the fact that younger individuals use local public services to a larger extent. In Figure 4 we plot the compensating variations for child care and education as a function of age implied by estimates in column I.

Figure 4. Compensating variation for child care and education as a function of age



The results reported in column II indicate that the demand for local public services does not vary with the income level of movers to a very large extent. There is, however, weak evidence indicating that the demand for other purposes expenditure is lower among high income earners. This may reflect the fact that high income earners do not qualify for social and housing assistance programs that are included in this item. There is also weak evidence suggesting that high income earners value high local taxes more negatively. In column III we report age (income) interactions holding income (age) fixed. The qualitative results are very similar to those obtained when each of this observed individual characteristic is considered separately.

Note that to include interaction terms with individual observed characteristics (e.g. age and income) is conceptually equivalent to introduce individual error components (the term $x'_{ic} \cdot age_i$ plays the role of $\upsilon_{ic} \equiv x'_{ic} \cdot \eta_i$). Hence, it relaxes the IIA assumption since it generates correlation across alternatives. However, the introduction of age and income interactions seems to reduce very little the unobserved heterogeneity for the demand of

child care and other purposes expenditures[20]. This suggests that, in our application, taking individual characteristics (age and income) into account is not sufficient to effectively relax the IIA assumption.

If the interest lies in exploring whether or not preferences for local public services vary by individual (observed) characteristics one alternative is to introduce municipal fixed effects in the utility specification. This eliminates the risk of omitting relevant variables at the municipal level but implies that variables that only vary across municipalities (e.g. local public services and the tax retention rate) can no longer be estimated. In Table 5, we report the estimates of this exercise. We are aware that this is somehow inconsistent with previous mixed logit specifications since no random heterogeneity is accounted for here. However, introducing municipal fixed effects provides us with a specification that is less restrictive in a different way and we will use it as a robustness check.

Table 5.-Conditional logit results for choice of municipality including municipal fixed. Age and income interactions.

Variables	I Age	II Income	III Age & Income
Expenditure (in logs)			
Interaction: Child care×(age- $\overline{age}$)	-0.113		-0.115
	(0.021)***		(0.021)***
Interaction: Child care×(income- $\overline{income}$)		-0.155	0.097
		(0.231)	(0.234)
Interaction: Education×(age- $\overline{age}$)	0.097		0.108
	(0.043)**		(0.045)**
Interaction: Education×(income- $\overline{income}$)		-0.188	-0.435
		(0.420)	(0.437)
Interaction: Elderly care×(age- $\overline{age}$)	-0.030		-0.029
	(0.018)		(0.019)
Interaction: Elderly care×(income- $\overline{income}$)		-0.017	0.055
		(0.193)	(0.197)
Interaction: Other purposes×(age- $\overline{age}$)	-0.003		0.003
	(0.019)		(0.019)
Interaction: Other purposes×(income- $\overline{income}$)		-0.320	-0.319
		(0.205)	(0.208)
"Prices" (in logs)			
Interaction: ln(1- τ) ×(age- $\overline{age}$)	0.742		0.698
	(0.247)***		(0.256)***
Interaction: ln(1- τ) ×(income- $\overline{income}$)		4.590	2.993
		(2.516)*	(2.568)
Log-L	-3,939	-3,953	-3,933
# individuals	1,444	1,444	1,444

Notes: Income measured in thousand SEK. Standard errors in parenthesis. *** denotes statistical significance at the 1% level, ** at the 5% level, and * at the 10% level. Sample mean of income is 1.418 thousand SEK. Sample mean of age is 31.6 years. All specifications include municipal fixed effects.

[20] For instance, the standard deviation of the compensating variation for child care is only reduced from 0.29 to 0.28 when we introduce age and income interactions.

The qualitative results we obtain regarding age and income interactions parallel those obtained in Table 4. Demand for child care declines with age while demand for education increases with age. The deterrent effect of local taxes increases with age. There is also weak evidence that the high income earners, in comparison to their low income counterparts, value expenditure in other purposes less and low taxes more. The fact that the results reported in Tables 4 and 5 are qualitatively very similar gives us some confidence that the results reported throughout this paper are robust.

6. Concluding remarks

In this paper we have examined whether individuals are attracted to municipalities offering a more attractive bundle of local public services and income tax rates. We have found that high spending in child care and in "other purposes" (including, e.g., recreation and transfer programs) attracts migrants whereas high income taxes deter migrants. Our results are less conclusive with respect to the demand for education that only seems to matter, to a limited extent, for older individuals (those individuals that are more likely to have kids aged 7-15). Spending in elderly care does not seem to attract movers. However, the data we use is not really suited to estimate the demand for elderly care given that few movers in our sample are over age 50.

Conditional and mixed logit models yield different estimates of the (mean) effects of some local public services on utility. This is the first study that we know of to use the mixed logit model to estimate the impact of local public services on community choice. Hence, if this result is specific to our application or is, instead, a more general result is something to be uncovered by future research.

Heterogeneity in preferences at the individual level (in the mixed logit model) translates into heterogeneity in responses at the municipal level. For child care, we find that municipalities with high spending (in child care) experience the largest inflows of migrants when increasing expenditure in this category. Our results also indicate that the effects of changing child care spending in one municipality affect, to a larger extent, those municipalities with similar levels of spending in this item. If there is strategic

interaction in local spending, our results suggest that municipal authorities should pay special attention to what similar neighbors are doing[21].

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Appendix

A.1. Construction of the variable Education

Teaching expenditure at the compulsory level (E_c) was missing for four municipalities. For all municipalities, however, there is information about total expenditure at the compulsory level (T_c). For the municipalities with missing observations we applied the following imputation procedure. First we calculated the share of total expenditure devoted to teaching at the compulsory level: $\gamma_c = (E_c / T_c)$. Then we averaged γ_c for all municipalities where this ratio was observed, i.e., $\gamma = (\sum_c \gamma_c / 22)$. Finally, we imputed teaching expenditures for the communities with missing information as: $\hat{E}_c = \gamma \times T_c$.