Survival and Exits in Neighbourhoods: A Long-term Analyses

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ABSTRACT *Neighbourhoods form a frame for our lives. At the same time, neighbourhoods are themselves formed by mobility into and out of them. This paper studies who stays in and who leaves in two districts of Oslo. The empirical analysis is based on a survival model, estimated on a ten-year long longitudinal data set. because neither theory nor prior studies yield sufficient guidance to build an empirical model. We propose a way to nest and test survival models and utilise this in the model specification. We find that the intensity of the outflow of native Norwegian from an area is not to any substantial degree related to the size of the immigrant population. Hence, our results do not confirm the widespread narrative of white flight as a response to an increased immigrant population in areas of Oslo. Instead, the larger part of the outflow is explained by variables related to the life-course of families. Results do not suggest that increasing the ethnic or income diversity of Oslo neighbourhoods would substantially increase outflows of native Norwegians*

Keywords: Neighbourhoods, Residential mobility, Migration, Survival models, Oslo

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Introduction

The neighbourhood is an arena where large parts of our life take place, and our neighbours and neighbourhoods frame our everyday choices, our problems as well as pleasures. For good and for bad, strongly or not so strongly, the neighbourhood forms us. Through our choices of residential location and subsequent decision to stay or leave, each of us also shapes our neighbourhoods, both for ourselves and for our neighbours. The aggregate of these location choices and stay-or-leave decisions strongly affects both the states and the dynamic evolution of the neighbourhoods.

In order to understand how neighbourhoods evolve over time one needs to understand how the different components of population dynamics work. In this paper we intend to contribute towards one empirically important aspect of population dynamics at a neighbourhood level: the question of who stays and who leaves. Consequently, we also utilise the literature analysing the existence, magnitude and character of white flight (see e.g. Andersson, 2013; Galster, 1990). However, we direct our attention to other aspects of how the socio-economic composition of neighbourhoods is affected by exits, as well. Selective migration, both in- and out-flows may impact on neighbourhood development (Bailey & Livingston, 2008). Life course events and financial position are important drivers of neighbourhood survival and exits. Habits and inertia building up over time also play a role – survival generates survival as Edin & Englund (1991) and Nordvik (2001) have pointed out.

We show how both the characteristics of individual residents and of the neighbourhoods influence peoples propensity to relocate. Although it is not a paper on White flight per se, both the public debate (see Blom, 2012), and the very strong growth in the absolute number of inhabitants of a non-Norwegian background in Oslo (Friedrichs, 2014; Blom, 2012) makes both the mobility behaviour of non-Norwegian groups and the responses of the native Norwegians relevant in our context. Therefore, we must also address the question of white flight.

We start out with the population and its distribution over neighbourhoods in Oslo at the beginning of 1998. We then ask how large shares of the initial residents survive as residents of their initial neighbourhood over each of the ten following years. More concisely: what characterise those who leave and those who stay, and even more importantly, how is individuals' propensity to leave related to characteristics of the neighbourhood. Thus, the paper concerns neighbourhood survival in the Norwegian capital Oslo, and we estimate a system of survival functions on a longitudinal data set extracted from administrative registers.

The literature on urban segregation shows that preferences over neighbourhood mix and mobility behaviour differs between ethnicities (Cutler *et al*., 1999; Zhang, 2011). In a Norwegian context, this is demonstrated by Turner & Wessel (2013). In order to illustrate and test for differences we present estimates for the aggregate group with an Asian country background together with estimates for native Norwegians. Admittedly, there can be major heterogeneities also within the aggregate Asian group, but less so than in e.g. the aggregate of all (non-western) immigrants.

Our study estimates neighbourhood survival in Oslo using individual level annual register data over a ten-year long period. Because of data limitations, some related studies have relied on (parametric) comparisons of the aggregate populations at two points in time (for example Card *et al.,* 2008; Boustan, 2010). Even though both of them use more than two points in time, their empirical IV-strategies utilise pairwise comparisons of the population at the times when census data were collected. Longitudinal panel data gathered from administrative registers enable us to analyse exits at higher frequencies and to utilise time-varying covariates, while avoiding the problems of sample attrition in survey-based panel data.

Neither prior research nor theoretical argument provide sufficient constraint to narrow the set of possible empirical specifications of our set of survival models sufficiently. We handle this by starting out with an extensive set of possible specifications, nested within each other, then we test sets of models against each other using a LR-test. The set of survival models that survives our tests, utilises a disaggregated split of the sample. Hence, mechanisms generating exits and stays in neighbourhoods do differ both between demographic groups and between geographical areas. The set of specification tests are a necessary component of our ambition to extend the empirical knowledge on neighbourhood stability and change.

Still, our study is a macroscopic study that investigates neighbourhood dynamics and survival in broadly defined areas and imposes a number of assumptions of coefficient homogeneity across groups and locations. As such, our study reveals some interesting patterns, but it is equally important that it can work as a frame for hypotheses that can and should be studied with a less macroscopic approach. Throughout our study, we will operationalize the theoretical concept of a neighbourhood[1] by the Census tract (Denton & Massey, 1991; Galster, 2008). Hence, we follow Denton & Massey (1991, p. 43) when they

[1] The terms neighbourhood, Census tract and tract will be used interchangeably throughout the paper.

assume that *they* [census tracts] *represent a reasonable approximation of the concept of a neighbourhood*.[2]

Combining two properties of our paper offers major advantages as compared to the existing literature. Firstly, we utilise annual register data on individuals. Secondly, we study individual stability and mobility over a ten-year period.

After the introduction, we proceed in Section 2 with a brief empirical overview of neighbourhoods and survival in Oslo, together with some descriptive statistics. Section 3 contains a selected overview of prior studies. Our data sources are described in Section 4. In Section 5, we go through a number of issues on specification and model selection. Estimates of the chosen model and interpretations of the results are presented in Section 6. A brief discussion of implication of our findings in a social mix perspective is given in section 7. Section 8 gives some short concluding remarks.

Empirical Background

The overarching question in our paper is how large shares of the initial pool of inhabitants stay and who are those who stay (or survive) in a neighbourhood over time and how this differs between neighbourhoods. In other words, how does out-migration from a neighbourhood create scope for change? As discussed above we define a neighbourhood pragmatically as a census tract. In total there were 552 census tracts in Oslo with an average of 1 015 inhabitants in 1998, some of the tracts are quite small, but 85 percent of them have more than 200 inhabitants.

We have chosen to study two major sections of Oslo: the western and the northeastern. One can say that there is a social gradient that points from Oslo northeast to the western section of the city, Turner and Wessel, 2013. Average incomes and wealth are highest in West, as are the house prices. This pattern has prevailed for at least one hundred years. The total adult **(**20+**)** population in Oslo was 391 000 in 1998, of those 22.4 percent resided in western Oslo, while the northeast Oslo contained 18.0 percent of the Oslo population.

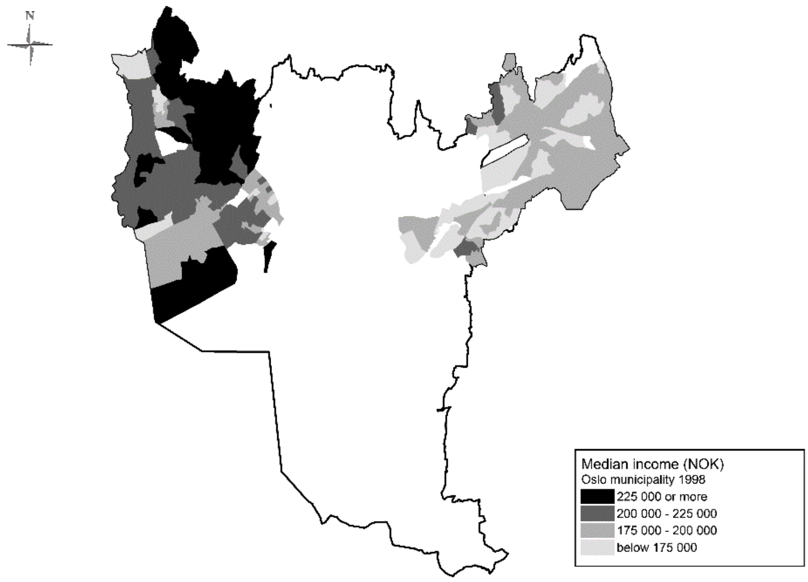
In part, we study patterns in out-migration and its role in neighbourhood change around the turn of the century and some years afterwards. The share of inhabitants with a country background from Africa or Asia in the northeastern part of Oslo grew from 16 in 1998 to 30

[2] Census tracts in Oslo have on average about one fifth of the number of inhabitants that the tracts Denton and Massey (1991) refer to, have. The similarity lies in the tracts being available units for which we have statistical information. We use them as approximations for neighbourhoods.

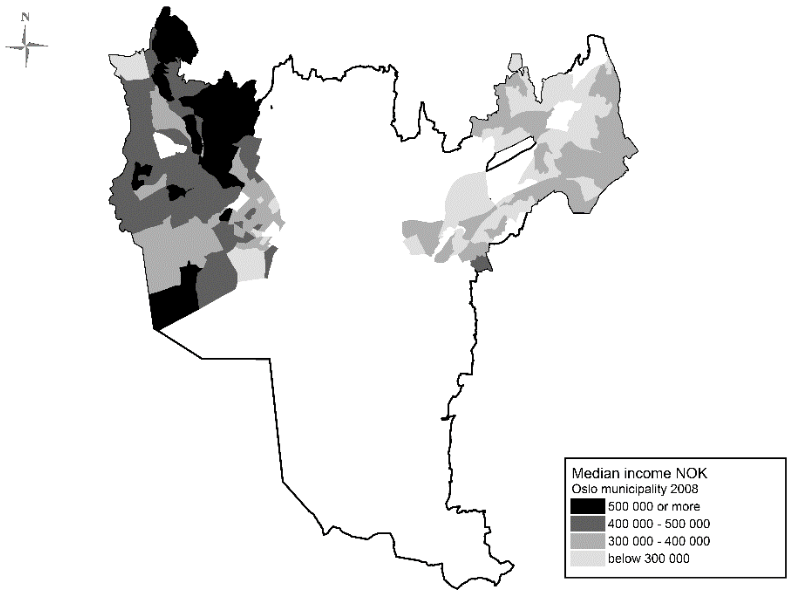
percent in 2008. For the whole of Oslo, the corresponding figures were 10 and 15 percent. These simple figures, together with the public concern about neighbourhood change in the Northeast of Oslo makes it imperative to study this part of Oslo. The Western part is included both as a contrast and to test whether differences in out-migration can be explained by the covariates we are using.

To illustrate the differences between the two areas in our study Map 1a-d show the shares of people with an Asian or African country background in the tracts in our two study areas in 1998 and 2008, together with median income of males aged 35-60 years.

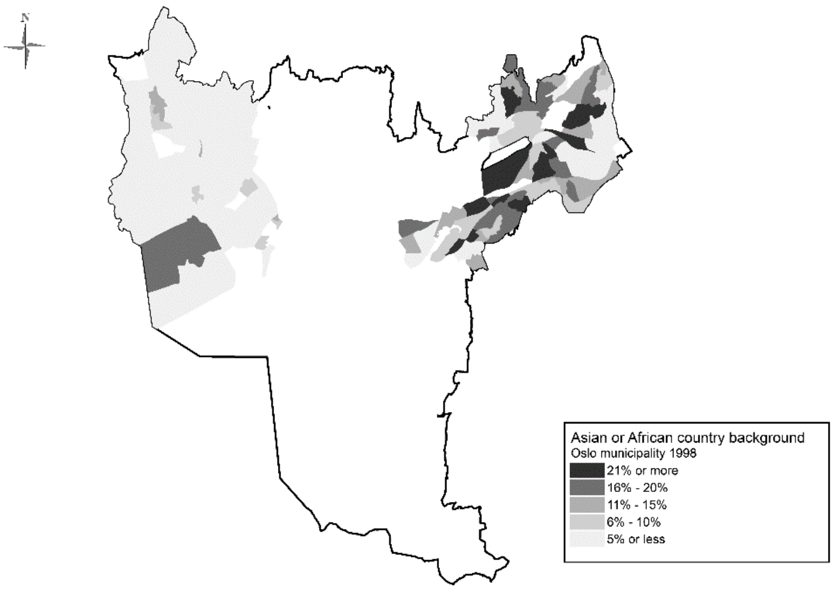
Map 1a – Median male income in Census tracts, 1998



Map 1b – Median male income in Census tracts, 2008



Map 1c – Share of Asians and Africans in Census tracts, 1998



Map 1d – Share of Asians and Africans in Census tracts, 2008

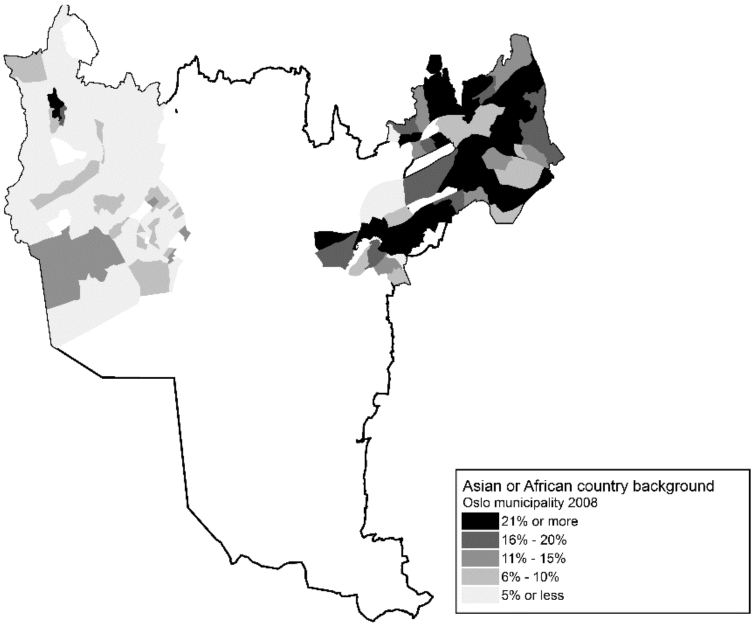


Table 1 below documents some other important differences between the two areas studied.

Table 1 - North-eastern and western districts Oslo, some key figures

	Northeastern Oslo	Western Oslo	Whole Oslo
Share Asians and Africans, 1998	15.6	3.1	10.0
Share Asians and Africans, 2008	29.9	4.7	15.3
Median male income 1998 (35-60)	277 300	389 700	297 700
Median male income 2008 (35-60)	395 700	603 800	448 700
Share of population <20 years old, 2008	24.6	18.9	20.9
Share of population >70 years old, 2008	9.1	10.3	8.9
Home prices 2009, 1000's NOK, median	1 655	3 100	2 050
Tract size, average	1 175	996	1 015

The figures in table 1, together with the maps above, confirm our claim that the northeastern and western districts of Oslo represent quite different parts of the socio-spatial hierarchy of Oslo. Still it will not be correct to describe the northeastern district as a deprived area.

In the two areas studied here, the people with an Asian country background covered 6.6 percent of the total adult population and 32.0 percent of the population with a non-Norwegian country background. As already mentioned, the Asian group is heterogeneous with regard to country background. The Pakistanis was the largest group with 29.5 percent of the Asian population Sri Lankan (11.5%) and Vietnamese (10.9%) are the second largest group.

If we take a rough look at the whole population of the Oslo, we find that after 5 years one-half of the adult population in 1998 had left the neighbourhood where they lived in 1998. After ten years one third remained in the same neighbourhood as where they resided at the start of our period. Hence, residential relocation most certainly is a possible source of demographic neighbourhood change. In figure 1a-c we show the complete survival functions for Oslo and for Norwegians and Asians in the two geographical areas within Oslo we are focusing on.

Figure 1a Neighbourhood survivals Oslo 1998-2008

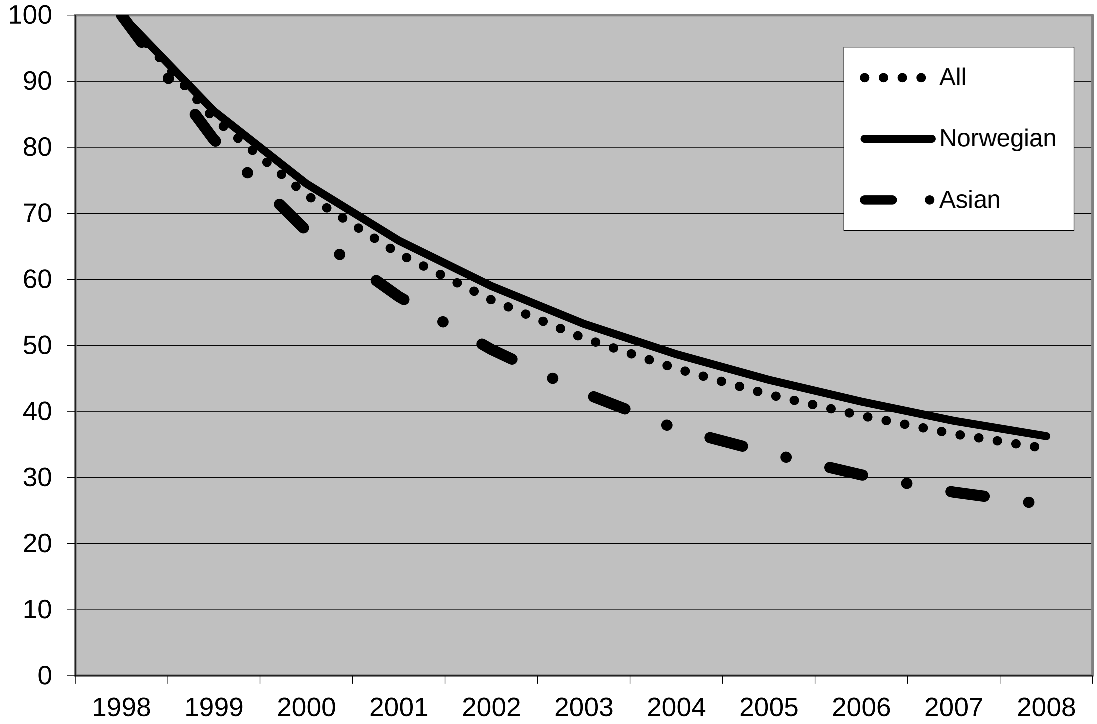
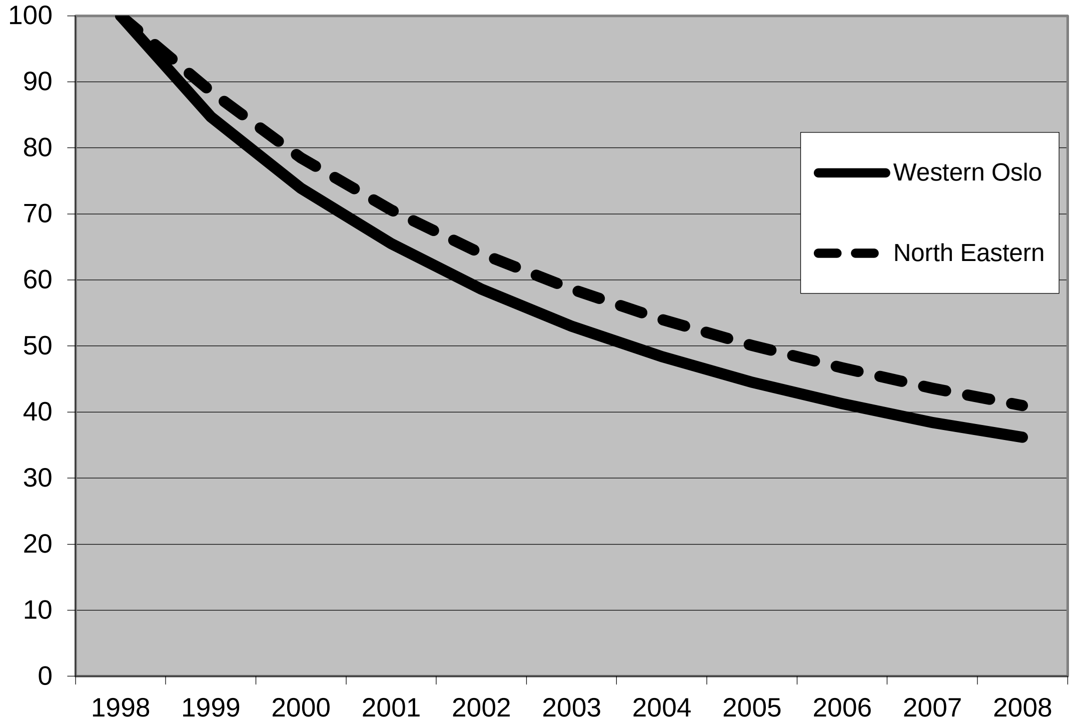


Figure 1b Neighbourhood survivals Oslo 1998-2008, Norwegians



The survival curves in Figure 1a-c show how large a share of the 1998 population (measured in percent) were still present in the following years. They reveal some interesting patterns. Firstly, the concave decrease of all the survival curves implies that the absolute number of individuals from the original 1998-pool of inhabitants, leaving a neighbourhood is decreasing over time. Constant hazards suffices to produce such a pattern. We see that Asians have lower survival rates in their 1998-neighbourhood than the Norwegians had.

Survival is highest in the northeast which by many is believed to be the least popular area with the lowest home prices and highest share of non-Norwegian inhabitants – survival here is highest, also for Norwegians. This may make one sceptical to claims that Oslo northeast is experiencing white flight, as is frequently claimed in the public debate. However, in order to draw conclusions about what determines the patterns revealed in the charts above one needs to rely on the multivariate analyses that we will turn to later.

The graphs above show the central tendencies. However, one should be aware of the fact that there are large variations in the survival rates between neighbourhoods. An important part of the empirical analyses in the paper is our attempt to identify the covariates of these variations.

Our analytical focus is on individuals in neighbourhoods. In table 2, we present the data used in the multivariate analyses in section 6. In a longitudinal survival analysis, descriptive statistics will be complex and a bit clumsy. Those statistics reported in, say, the column for 2003 is calculated for those who are at risk of leaving their neighbourhood in 2003, i.e. those that have stayed in the neighbourhood up to 2002. The number of individuals in the at-risk-pool of inhabitants is strictly decreasing over time. Non-random exits produce the pattern where the means and standard deviations of time-invariant variables change over time.

The data utilised in the analyses can be divided into four types: an indicator y for moving out of the neighbourhood in the period; time-invariant characteristics of the individuals; time-varying characteristics of the individuals and characteristics of the neighbourhood. Except for the west-dummy, all the neighbourhood characteristics included are time varying. In the table of descriptive statistics below the different types of variables are separated by **bold** lines.

The second set of variables is the time invariant individual characteristics, except for the age in 1998 and 'Stay prior' these variables are dummy variables: they express the share of males, Norwegians, Asians and first and second generation immigrants. For the immigrants we have also included dummy-indicators for time of arrival in Norway. The variable 'Stay prior' is the number of years a person has stayed in her neighbourhood prior to 1998. This variable is truncated at 6 years due to data limitations.

The next set of variables is individual characteristics that vary over time. The first of them counts the number of adults and children in different age groups in the families. University is a dummy variable indicating that the person holds a bachelor degree or an equivalent education. Ln Income is the natural log of the post-tax income, while 'neg income' is an indicator for the rather few individuals who have a strictly negative registered income.

In the final set, we have included shares of inhabitants with a non-Norwegian country background, who have a university degree and income below a low-income threshold. Median income is a measure of the median income level in the neighbourhood. Part of the motivation for the paper is to test whether country background of the population in a neighbourhood affects out-migration. The measures of education and neighbourhood affluence are included as these variables often are assumed to affect both the quality of local public goods and (local) social capital (Hoff & Sen, 2005; Sethi & Somanathan, 2004).

Some words of caution are needed when it comes to interpretation of the time-varying covariates. The prime purpose of the variables lies in the analyses of the interdependencies between y and the covariates. The variable y for e.g. the year 2001 identifies those who have left the neighbourhood (for any other reason than death) between 1.1 2000 and 1.1 2001. We find it more probable that this is explained by family composition, neighbourhood qualities etc. in year 2000 rather than in 2001. For that reason, all time-varying covariates reported in table 2 are lagged by one year.

Table 2 – Descriptive statistics – individuals by year

	1999		2000		2001		2002	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Moved out, y	0.123	0.33	0.108	0.31	0.094	0.29	0.085	0.28
Male	0.467	0.50	0.464	0.50	0.461	0.50	0.460	0.50
Age 1998	47.9	18.4	49.07	17.97	50.03	17.52	50.77	17.01
Norwegian	0.924	0.27	0.925	0.26	0.927	0.26	0.929	0.26
Asian	0.076	0.27	0.075	0.26	0.073	0.26	0.071	0.26
First generation	0.069	0.253	0.068	0.25	0.068	0.25	0.065	0.25
Second gen.	0.003	0.05	0.003	0.05	0.003	0.05	0.002	0.05
Arrived 1997-98	0.003	0.06	0.003	0.05	0.003	0.05	0.002	0.04
Arrived 1991-96	0.014	0.12	0.013	0.11	0.013	0.11	0.011	0.10
Arrived 1981-90	0.035	0.18	0.035	0.18	0.035	0.18	0.034	0.18
Stay prior	3.46	2.28	3.60	2.25	3.72	2.23	3.88	2.18
Adults	1.78	0.86	1.77	0.83	1.77	0.83	1.81	0.82
Children 16-18	0.047	0.22	0.047	0.22	0.047	0.22	0.048	0.22
Children 11-16	0.107	0.37	0.114	0.38	0.114	0.38	0.134	0.41
Children 6-11	0.120	0.39	0.128	0.40	0.128	0.40	0.134	0.41
Children -6	0.159	0.460	0.161	0.46	0.161	0.46	0.144	0.44
University	0.282	0.45	0.282	0.45	0.282	0.45	0.283	0.45
Ln Income	11.776	1.63	11.89	1.55	11.96	1.55	11.96	1.68
neg. Income	0.005	0.07	0.005	0.07	0.005	0.07	0.009	0.09
% Western	10.17	4.99	10.12	5.10	10.00	5.09	9.86	4.97
% Other Eur.	1.77	1.03	1.85	1.04	2.00	1.12	2.09	1.14
% African	2.00	1.89	2.14	2.00	2.32	2.22	2.45	2.28
% Asian	7.76	8.23	8.42	8.75	8.91	9.18	9.46	9.70
% South amer.	0.84	0.69	0.86	0.66	0.88	0.63	0.89	0.64
% University	25.44	12.59	25.81	12.63	25.93	12.5	26.40	12.62
% low income	22.63	4.29	22.29	4.10	22.36	4.31	22.47	4.34
Median income	15.63	1.53	16.83	1.65	17.84	1.77	18.74	1.79
West end	0.537	0.499	0.526	0.499	0.522	0.499	0.518	0.500

	2003		2004		2005		2006	
	Mean	SD	Mean	SD	Mean	SD	Mean	SD
Moved out, y	0.077	0.27	0.068	0.25	0.060	0.24	0.053	0.22
Male	0.455	0.498	0.451	0.50	0.448	0.50	0.447	0.50
Age 1998	51.30	16.49	51.69	15.97	51.94	15.50	52.00	15.05
Norwegian	0.931	0.25	0.933	0.25	0.935	0.25	0.935	0.25
Asian	0.069	0.25	0.067	0.25	0.065	0.25	0.065	0.25
First generation	0.064	0.24	0.062	0.24	0.060	0.24	0.060	0.24
Second gen.	0.002	0.05	0.002	0.05	0.002	0.04	0.002	0.04
Arrived 1997-98	0.002	0.04	0.001	0.04	0.001	0.04	0.001	0.04
Arrived 1991-91	0.010	0.10	0.010	0.10	0.009	0.09	0.009	0.09
Arrived 1981-90	0.033	0.18	0.032	0.18	0.031	0.17	0.031	0.17
Stay prior	3.88	2.18	3.92	2.17	3.97	2.15	3.99	2.14
Adults	1.82	0.81	1.82	0.81	1.82	0.81	1.86	0.80
Children 16-18	0.052	0.23	0.055	0.23	0.059	0.24	0.062	0.25
Children 11-16	0.140	0.42	0.145	0.43	0.150	0.43	0.152	0.44
Children 6-11	0.134	0.41	0.133	0.41	0.130	0.41	0.125	0.40
Children -6	0.128	0.42	0.109	0.39	0.093	0.36	0.076	0.32
University	0.283	0.45	0.284	0.45	0.285	0.45	0.287	0.45
Ln income	12.020	1.69	12.06	1.73	12.10	1.70	12.19	1.66
neg. Income	0.009	0.09	0.009	0.09	0.008	0.09	0.006	0.08
% Western	9.82	5.06	9.69	4.89	9.69	4.88	9.64	4.89
% Other Eur.	2.32	1.21	2.46	1.30	2.61	1.32	2.83	1.42
% African	2.69	2.46	2.81	2.61	2.90	2.67	3.01	2.82
% Asian	10.20	10.17	10.73	10.52	11.20	10.78	11.73	11.14
% South amer.	0.94	0.66	0.976	0.65	1.03	0.64	1.06	0.63
% University	26.67	12.65	27.21	12.83	27.80	13.09	28.40	13.40
% low income	23.28	4.60	24.03	4.97	24.50	5.13	24.76	5.38
Median income	19.71	2.01	20.53	2.13	21.02	2.32	22.28	2.77
West end	0.516	0.50	0.513	0.50	0.511	0.50	0.509	0.50

	2007		2008	
	Mean	SD	Mean	SD
Moved out, y	0.051	0.22	0.041	0.20
Male	0.446	0.50	0.444	0.50
Age 1998	51.95	14.65	51.82	14.26
Norwegian	0.937	0.24	0.937	0.24
Asian	0.063	0.24	0.063	0.24
First generation	0.059	0.24	0.058	0.23
Second gen.	0.002	0.04	0.002	0.04
Arrived 1997-98	0.001	0.04	0.001	0.03
Arrived 1991-91	0.008	0.09	0.008	0.09
Arrived 1981-90	0.030	0.17	0.030	0.17
Stay prior	4.00	2.13	4.02	2.13
Adults	1.86	0.80	1.86	0.80
Children 16-18	0.064	0.25	0.067	0.26
Children 11-16	0.151	0.44	0.150	0.44
Children 6-11	0.117	0.39	0.104	0.39
Children -6	0.061	0.29	0.049	0.29
University	0.289	0.45	0.291	0.45
Ln income	12.19	1.62	12.29	1.56
neg. Income	0.007	0.08	0.006	0.08
% Western	9.63	4.94	9.71	5.04
% Other Eur.	3.18	1.79	3.74	1.94
% African	3.15	3.02	3.29	3.19
% Asian	12.16	11.44	12.76	11.59
% South amer.	1.09	0.64	1.12	0.67
% University	29.05	13.67	29.46	13.75
% low income	23.94	5.32	23.60	5.25
Median income	23.31	2.75	25.37	3.19
West end	0.509	0.50	0.508	0.50

The table reveals many interesting patterns. We will not engage in a lengthy discussion of these, only make a couple of observations. The probabilities of leaving the 1998-neighbourhood are strictly decreasing over time, from 0.123 in 1999 down to 0.041 in 2008. If we define Asians and Africans as non-whites, we see that the average inhabitant in 1999 lived in a neighbourhood with 9.8 percent non-whites; in 2008, this figure had increased to 16.1. This is an increase of as much as 64 percent over a ten-year long period.

One may note that our descriptive statistics do not contain information on tenure. The reason for this is that we do not have reliable information on this at the individual level. It has been demonstrated numerous times that tenants move more frequently than owner-occupiers do (e.g. Andersson, 2013). Still, we will argue that our lack of data on tenure is not problematic. In an owner-occupation dominated housing market such as the Norwegian, with hardly any purpose-built rental housing, it is more reasonable to think that instability and moving plans cause households to rent, rather than the other way around. If tenure were to be included in our models, it would yield a simultaneity problem that would bias coefficients of other life course variables.

The descriptive statistics reported in table 2 are calculated on a sample consisting of all Asian and Norwegian individuals living in the two areas of Oslo we have defined as the western part and the north-eastern part of Oslo. Obviously, it would have been interesting to report descriptive statistics for combinations of geographical areas and demographic groups. As this would be rather space consuming we have refrained from including it here.

Prior Research

Moving from one place to another is for many a major event in the life course. It is often something that is thoroughly planned and thought through. Unexpected events may change these plans – for good or for bad. Residential relocation should therefore be seen as situated at the intersection between forward-looking, rational planning, revisions to changing circumstances and necessary adaptations and reactions to random shocks (Muth, 1974; Kan, 1999; Nordvik, 2001). The decision to move depends also on neighbourhood characteristics, just as the flows of moves affect the character of a neighbourhood. The question of who stays on when the situation changes or when a neighbourhood changes, is part of a study of inter-dependencies between neighbourhood dynamics and mobility. What role does the neighbourhood play in the mobility process?

The decision to move house can be triggered by a range of factors, including life events such as marriage, child-bearing, divorce etc. and entrance into the labour market or retirement (Morrison, 1973; Feijten & Mulder, 2002; Li & Li, 2006; Mulder, 2006; Simpson *et al*., 2008; Turner & Hedman, 2014). In short, stage in the different arenas of the life course affect spatial mobility. Young people are more inclined to leave their residential area, than are elderly inhabitants. Singles are more mobile than couples are, and children do in general depress out-mobility. Kan (1999) argues that the moving cost of a family is some aggregate of the moving costs of the individual members of a family. Furthermore, the age of children plays an important role in the mobility paths of families.

One can argue that transitions into new phases in the life course causes relocations. Demographic events, such as couple formation, the birth of a child or couple dissolution, represent new phases in the life course. An alternative view is proposed by Feijten & Mulder (2002). Demographic events and location choices occur simultaneously, for instance, sometimes relocation due to the needs of children precedes the arrival of the children themselves. Feijtens & Mulders observed that the delays in child bearing in the eighties and nineties, did not lead to delays in entry into owner-occupation. To account for this we formulate our empirical models in terms of states, rather than in terms of transitions.

A recurrent issue in residential mobility research, and particularly in US research on the white population's mobility behaviour, is to what extent out-migration from neighbourhoods is an expression of in-group or out-group preferences. Another issue is whether ethnic preferences in reality are a proxy for socioeconomic factors with which ethnicity is associated; such as crime levels and house prices (Lewis *et al*., 2011; Emerson *et al*., 2001). Early studies has interpreted the exit of white people as a flight from integrated neighbourhoods, motivated by (fear of) falling property values, increases in crime and a fear that the neighbourhood was going to be thoroughly black, see e.g. Wolf (1963) and Bailey (1966). Later studies demonstrate a similar picture (Wurdock, 1981; Galster, 1990, 2012).

A more nuanced picture of white flight is presented in an ethnographic study about whether to stay or to move out when the neighbourhood changes due to a black in-migration (Woldoff, 2011). Woldoff argues that the white flight terminology fails to capture the full picture of mobility behaviour, not all of the white residents moved out and some blacks did. The elderly stayed and assumed the role as the bearer of the neighbourhood's culture. However, as the ethnic change proceeded many white residents did move out, not because of an increasing number of black inhabitants, but because of a feeling of lost neighbourhood amenities.

A few European studies have focused on the interdependency between neighbourhood character, dynamics and mobility. Bråmå (2006) concluded that an increased residential segregation in Swedish neighbourhoods was only to a very limited degree an effect of an out-migration of Swedes; natives' avoidance behaviour was quantitatively more important. This conclusion was based on findings demonstrating a greater imbalance between Swedes and immigrants in in-migration flows than in out-migration flows. Bråmå also pointed to natural population changes as the cause of an increased minority population in neighbourhoods undergoing a change in the ethnic composition, the relevance of this is also emphasised by Simpson *et al.* (2008) as well.

The effect of neighbourhood change on the resident's wish to exit was studied with data from the Netherlands by Feijten & van Ham (2009). They found an increasing wish to move out from neighbourhoods with a high level of population turnover and with an increasing share of non-Western minorities. However, changes in socioeconomic status of the neighbourhood did not affect residents' desire to move. A study of actual moving behaviour and ethnicity in the Netherlands by Schaake *et al.* (2010), found the ethnicity at the individual level to be of minor importance when explaining exits from a neighbourhood. However, a combination of ethnicity at the individual level and at the neighbourhood level was an important factor for geographical mobility. They also found that ethnic minorities to a greater extent moved within the neighbourhood, whereas natives moved out of the neighbourhood. Crowder *et al.* (2011) discuss ethnic differences in mobility behaviour, and argue that the mechanism though which the immigrant concentration affects mobility decision varies between ethnic groups.

Data

Our study uses a unique longitudinal database. We have annual data for all adults who lived in Oslo in the period 1998 to 2008. The data is compiled by Statistics Norway, from a number of different public registers. Note that the data are complete in the sense that we include all residents of the groups and areas that we are studying. As data is taken from registers, we do not need to consider problems associated with non-random missing observations. Data taken from registers allows us to capture dynamic patterns far better than would be possible using data taken from (relatively infrequent) census files (see e.g. Boustan, 2010; Card *et al*., 2008).

Prior studies have revealed that mobility behaviour differs quite strongly between demographic groups and between geographic areas, partly because different parts of a city play different roles in the life course of households (see Cutler *et al.*, 1999; Dieleman & Mulder, 2002). Furthermore, there are no obvious arguments that only the location of (e.g.) survival curves differs, also the shape (or slope) may very well differ geographically and between demographic groups.

The two major demographic groups we focus on here are people with Norwegian and Asian country background. Country backgrounds is, for statistical purposes, defined by Statistics Norway as based on a person and his/her parent's country of birth. It is a kind of country-of-origin measure. Hence, it is important to note that country background is not the same as either ethnicity or formal citizenship.

Some Issues on Specification

Both theoretical and empirical studies on mobility and neighbourhood change and the specialised statistical literature provide guidelines for specification of an empirical model of neighbourhood survival of individuals. However, these guidelines do not constrain the set of suitable empirical specifications to a single model. Choice of specification is consequently an empirical task – an empirical task guided, but not determined, by theory and prior research. Still, there is also evidently an element of pragmatic choice embedded in model specification. The purpose of this section is both to utilise the constraints and advice we can obtain through testing and to illustrate some of the pragmatic choices one needs to make as part of empirical model choice-exercises.

The basic idea behind our empirical strategy is that we transform our data set consisting of information on each person over a period of 11 years into a person-year data set (Rabe-Hesketh & Skrondal, 2008). Using this person-year data set we model the probability that an individual who has been residing in the neighbourhood continuously from 1998 up to year *T*-1, exits from the census tract during year *T*, i.e. we model hazard rates conditional on survival up to *T*-1 and on a set of covariates ***X***. ***X*** contains both time-varying and time-invariant covariates.

(1) $h(t) = P(T = t_i \mid T \geq t_i, X)$

We choose to specify *h(t)* as a logit. This is equivalent to fit a logit model to a data set where each combination of person and year is treated as one observation for as long as the person is at risk for moving out for the first time since the start of our observation period in 1998. The data-lines of each observation are of the form (y, **D**, **X**) where:

- y — is an indicator equal to zero up to a departure from the neighbourhood. Upon departure it takes a unity value.
- **D** — is a vector of dummies for which year the person-observation belongs to.
- **X** — is a set of covariates described in more detail later on.

The resemblance of our model to a Cox regression is obvious. Let us for a moment assume that all components of **X** are time-invariant. The estimated coefficient of the each of the co-variates then is a factor that shifts the log-odds-ratio. Hence, in this case the model is constrained by a proportional odds assumption. In general, this can be a bit awkward, but far less so when using a battery of time-varying covariates (Rabe-Hesketh & Skrondal, 2008).

The survival function can be written as in equation (2) using estimated hazard rates:

$$(2)\quad P(T > t \mid X) = \prod_{i=1}^{t} \{1 - h(i, X)\}$$

Even if we have decided to use a logit hazard model as our modelling frame and assume that the use of time-varying covariates makes the proportional log-odds-ratio constraint less problematic, some questions need to be addressed concerning the specification of our empirical model.

We want to estimate how survival is affected by individual characteristics of the inhabitants in census tracts and how characteristics of the neighbourhood affect the individual survival propensities. If there are unobserved characteristics of the neighbourhood that affect individual choices; choices made by inhabitants in the same neighbourhood will be correlated. Choices may be correlated even conditional on the set of covariates, ignoring this may bias coefficients. In the context of survival models, this is sometimes called the shared frailty problem (Chen, 2008; Box-Steffensmeier & Jones, 2004). The shared frailty problem can be dealt with by formulating a random intercept model; frailty shared by inhabitants of a census tract is captured by the distribution of the random intercepts (Rabe-Hesketh & Skrondal, 2008).

For some of the specification candidates, we included such a frailty term shared at the neighbourhood level. The estimations revealed a parameter for the frailty term significantly larger than zero. However, the magnitude of the frailty parameters was very small- implying a within neighbourhood residual correlation (i.e. a rho-value) ranging from 0.005 to 0.01.[3] Furthermore, the coefficients of the covariates were quite similar in models with and without the frailty term. Interpretations and discussions of marginal effects in the random intercept model are a bit cumbersome, and estimations are time-consuming. Consequently, as the results are so similar, we stick to the simple logit formulation in the remainder of the paper.

Estimating the survivals of the 1998 residents, our data will suffer from left censoring. Some residents have recently moved in, while others have stayed in the neighbourhood for a

[3] Rabe-Hesketh & Skrondal (2008) describes a rho-value of 0.1 as *suggesting that there is not much dependence* p. 362.

long time. In our database, we have access to information on residential location for six years prior to 1998. We utilise this information by including a polynomial of the length of prior stay among the covariates in the model. An alternative to exits from a neighbourhood is within-neighbourhood mobility. The opportunities for with-neighbourhood mobility obviously vary with the size of the neighbourhood. In order to control for that we include a control for the size of the population in the neighbourhood in our estimations.

The purpose of our study is to reveal mechanisms yielding individual exits and stays in neighbourhoods among people with Asian and Norwegian background in two large sections of Oslo. A frequent way to handle this is to estimate a model on the full sample and to include dummy-variables for the groups in question. This is equivalent to constraining all other coefficients to be equal across groups and locations. I.e. to assume that the shape of survival curves are equal across demographic groups and geography while allowing locations to differ since the dummy-coefficient works like a location shifter.

To illustrate the point: Is it reasonable to assume that the impact on the exit-stay decision of an increase of the income of say two standard deviations is the same for an Asian family with three children as it is for a single Norwegian. Furthermore, is it reasonable to constrain the effect to be equal across geographical locations? The obvious answer is that it is difficult to say, and that there is a need for some combination of common sense and rigorous statistical testing.[4]

One way to allow for coefficient heterogeneity could have been to include a (sufficiently large) number of interaction terms. Including a large number of interaction effects on the other hand yields a messy picture in a non-linear model such as the logit; a messy picture in which statistical testing is really cumbersome and where even interpretations of the signs of estimated coefficients might be misleading (Ai & Norton, 2003). One way to avoid these problems of interaction terms in non-linear models would of course be to use a linear model. For a number of reasons we find this alternative less attractive. Instead, we use an alternative (and quite simple) approach to allow for coefficient heterogeneity by comparing models estimated on different subsamples.

Our way to test for coefficient heterogeneity and for a suitable sample split is to first estimate a model on the full sample. Dummy-variables for location and demographic groups are included in the full-sample model. Then we split the sample into two subsamples: one

[4] As we do not have access to the appropriate hardware for exercising of common sense, we rely more on statistical testing.

consisting of residents of the west (W) and one of the northeastern (NE) residents of the city. Next, we estimate similar models on both these two samples. In the full-sample model, the coefficients of each of explanatories are constrained to be equal at the two geographical locations. The W- and NE-model taken together can be regarded as a model that allows for different coefficients across geography. Consequently, we can view the full model as nested within the W- and the NE-models taken together and we test the assumption of coefficient equality using a traditional LR-test with a number of degrees of freedoms equal to the difference between the total number of coefficients in the two sub-models and in the model called the full model here. Tests of the models nested within each other in this way guide our choice between full sample estimation and splitting the sample according to geography.

In order to facilitate the set of tests we run a series of logit models on different subsamples. The *LogLikelihood*–values resulting from ML estimation of our survival model on different subsamples, are reported in the table below. The exact set of covariates used in these estimations is described in the next section.

Table 3 – The maximum of the *LogLikelihood* under different specifications

	Sample	*LL*	**Number of estimated coefficients**
M1	Full sample	- 218,627.48	39
M2	North-eastern	- 101,437.33	38
M3	Western	- 116,823.68	38
M4	Norwegian origin	- 197,826.74	32
M5	Asian origin	- 20,274.78	37
M6	Western Oslo, Norwegian origin	- 112,409.47	32
M7	Western Oslo, Asian origin	- 4,292.69	37
M8	North-eastern Oslo, Norwegian origin	- 85,187.99	32
M9	North-eastern Oslo, Asian origin	- 15,909.34	37

Direct applications of LR tests in our case are cumbersome as statistical tables often do not report the Q^2-distributions for more than 30 degrees of freedom. However, Johnston (1984) shows that if X is Q^2-distributed with n degrees of freedom, then for n>30, a measure z is approximately standard normal distributed:

(3) $$z = \sqrt{2X^2} - \sqrt{2n-1} \text{ where } z \sim N(0,1)$$

First, we test the combination M2 and M3 against M1. The z-score of this test is as high as 509.84. Hence, the hypothesis of identical coefficients in the western and in the north-eastern parts of Oslo is strongly rejected. Similarly, testing the combination of separate models for each of the two country-background groups (M4 and M5) against M1, gives us an even higher z equal to 735.39.

Similar tests are used to compare the fit of models estimated on different subsamples, as described in table 2. Based on the tests we continue with the disaggregated models M6-M9. These tests are not just preliminary exercises done in order to make a sensible choice of specification. Taken together the set of tests also demonstrates the substantial heterogeneity of survival and the interdependencies between neighbourhood survival and our set of explanatory variables. The differences in survival between demographic groups and locations cannot be captured by shift-parameters.

Results

We model the probabilities of leaving one's 1998-neighbourhood (P), through the years from 1999 up to 2008 by use of a quite simple logit-specification. We estimate the model on four subsamples defined by a combination of area and country-background. The logit-coefficients are reported in the table below, we report direct coefficients rather than odds ratios or average marginal effects. Coefficients that are significantly different from zero at a 5% -level of significance are marked with bold.

Table 4 – The propensity to leave the neighbourhood, Logit estimates

	Western Oslo				North-Eastern Oslo			
	Norwegians		Asians		Norwegians		Asians	
	Coeff	Se	Coeff	Se	Coeff	Se	Coeff	Se
D2000	**-0.144**	0.019	0.167	0.089	0.019	0.023	0.002	0.054
D2001	**-0.199**	0.024	0.053	0.113	**-0.084**	0.028	-0.117	0.067
D2002	**-0.206**	0.028	-0.103	0.139	**-0.167**	0.034	-0.106	0.081
D2003	**-0.269**	0.033	0.048	0.163	**-0.248**	0.040	**-0.209**	0.096
D2004	**-0.346**	0.038	0.112	0.184	**-0.373**	0.046	**-0.311**	0.110
D2005	**-0.405**	0.041	-0.330	0.211	**-0.453**	0.050	**-0.609**	0.122
D2006	**-0.563**	0.049	-0.232	0.241	**-0.547**	0.058	**-0.547**	0.138
D2007	**-0.533**	0.054	**-0.654**	0.286	**-0.588**	0.066	**-0.711**	0.159
D2008	**-0.812**	0.068	**-0.949**	0.357	**-0.786**	0.079	**-0.846**	0.189
Male	**0.031**	0.012	**0.116**	0.057	**0.053**	0.014	**0.139**	0.031
Age 1998	**-0.136**	0.002	**-0.048**	0.014	**-0.140**	0.002	**-0.068**	0.0087
Age squarred	**0.001**	0.000	0.0002	0.0001	**0.001**	0.000	**0.005**	0.0001

First generation			-0.062	0.103			**-0.278**	0.104
Second gen.			-0.340	0.180			-0.199	0.119
Arrived 1997-98			**0.488**	0.157			0.132	0.105
Arrived 1991-96			**0.498**	0.105			**0.299**	0.054
Arrived 1981-90			**0.269**	0.089			**0.120**	0.043
Adults	**-0.178**	0.007	**-0.073**	0.032	**-0.167**	0.009	**-0.145**	0.018
Children 16-18	**-0.199**	0.032	**-0.278**	0.120	**-0.178**	0.037	-0.034	0.046
Children 11-16	**-0.328**	0.020	-0.023	0.063	**-0.228**	0.022	0.006	0.026
Children 6-11	**-0.437**	0.019	**-0.138**	0.063	**-0.178**	0.019	**-0.116**	0.025
Children -6	**-0.033**	0.013	-0.027	0.051	**0.126**	0.015	**-0.080**	0.022
University	-0.014	0.012	-0.083	0.063	**0.096**	0.018	**0.096**	0.042
Ln income	0.003	0.005	**-0.034**	0.008	-0.004	0.007	-0.008	0.006
Neg. Income	0.047	0.082	**-0.726**	0.313	0.274	0.157	-0.126	0.243
% Western	**0.028**	0.003	0.020	0.014	**0.017**	0.006	**-0.042**	0.017
% Other Eur.	0.005	0.007	-0.050	0.036	0.005	0.005	**-0.030**	0.011
% African	0.012	0.07	0.009	0.029	**0.012**	0.004	**0.049**	0.010
% Asian	0.003	0.005	-0.040	0.021	**0.008**	0.001	**-0.006**	0.003
% South amer.	0.021	0.011	-0.009	0.044	**-0.038**	0.011	**-0.094**	0.022
% University	0.003	0.002	-0.012	0.011	-0.004	0.003	-0.003	0.007
% low income	**0.017**	0.002	-0.001	0.009	**0.005**	0.003	0.005	0.006
Median income	-0.002	0.006	-0.028	0.029	0.014	0.008	0.032	0.020
Stay prior	**-0.84**	0.011	**-0.155**	0.052	**-0.145**	0.014	**-0.170**	0.028
Stay prior sq	0.0002	0.002	0.009	0.008	**0.013**	0.002	**0.019**	0.004
Log Tract size	**-0.064**	0.017	**-0.286**	0.082	**-0.107**	0.014	**-0.158**	0.037
Const	**2.082**	0.176	**3.489**	0.885	**2.467**	0.196	**1.389**	0.443
n[a]=	428 808		10 758		358 627		48 281	
$\mathcal{LL}$	-112,409.47		-4,292.69		-85,187.99		-15,909.34	
Pseudo R^2	0.1189		0.0862		0.0877		0.0335	

[a] Note that n here does not measure the number of individuals, but the number person-year observations that the model is estimated on.

The coefficients reported in table 4 gives the effect on the expected log-odds ratios, of variations in the explanatory variables. A positive coefficient implies a positive effect on the probability of leaving the area. As most of us do not have any intuition of the magnitude of variations in the log-odds-ratio, we use equation (4) to calculate marginal effects, β and X are vectors of coefficients and explanatory variables. Note that the marginal effect of a variable in general varies both with the level of the variable itself and with the other variables. This is due to the non-linearities of (4).

$$(4)\quad P = \frac{1}{1+e^{-(\beta X)}}$$

The estimations reported in table 4 are rich and there is a lot to discuss. Here we focus on three different structures in the estimated results: falling intensity of out-mobility over time, the effect of children and differences in out-migration from tracts with different compositions of country background. Before going to the interpretation of our prime results, we just note that the controls in the models work as expected. Out-mobility is significantly decreasing in both prior stay in and in the size of the neighbourhood.

The magnitude and importance of the different coefficients and covariates are difficult to assess when using a logit. For illustrative purposes we create a standard (or reference) individual. One should think of this standard individual as an illustration and a typical individual – not necessarily as any average. As several of the explanatory variables are time-varying, some of the characteristics of the standard individual are therefore in the form of vectors rather than scalars:

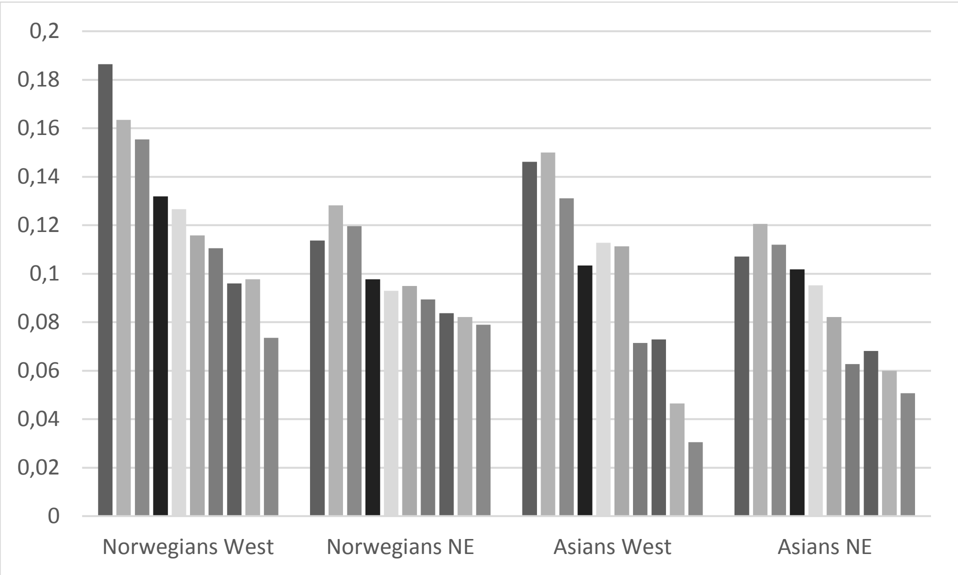
A female aged 35 years in 1998, and has resided in her 1998-neighbourhood from 1994. She lives alone with no children up to the start of 2002, when a cohabitant enters the scene. In 2003, she gives birth to a child. She enters period one without a university degree, but earns one in the course of the first year. The log of her post-tax income is equal to the average in the sample and it evolves over time according to this aggregate. Immigrant shares, shares of low-income individuals, persons with a university degree in the neighbourhood is equal to those averages reported in table 2, as is the median post-tax income in her neighbourhood. If she is an immigrant, she arrived to Norway before 1980. She resides in a tract with 1 000 inhabitants.

This reference person will be used in the discussions of the estimated models below. Changes in the explanatory variables will alter the exit probabilities (and survivals) over the whole time path. We will in our presentations mostly report and interpret changes in the probability that a household stays in the neighbourhood at least up to 2005.

Time Path of Exits

In all the estimations, we see a falling intensity of out-mobility over time. This we see by considering the decreasing trend of the coefficients of the dummy-variables D1999-D2008. This pattern is present in all four estimations. I.e. the probability of leaving the neighbourhood falls over time. Figure 2 illustrate how the moving probabilities for the reference person described above, evolve over time. For each group the figure starts with the probability of moving out in 1999 and continues with the probability of out-migration up to 2008.

Figure 2 – Probability of moving out of the 1998-neighbourhood



There are two obvious explanations of the pattern in figure 2. Firstly, the attachment to a neighbourhood, both in practical and emotional terms, grows over the time you stay. *Observing this structure, Edin & Englund (1991) concluded that it often is not correct to assume that recent movers are in equilibrium*. Secondly, those most inclined to leave, leave first. This latter structure is found in very different empirical applications of survival models: see e.g. Chen (2008).

The time dependency described here is, apart from being interesting in its own right, important for modelling of mobility. If different groups are differently distributed according to history in the neighbourhood, failure to account for this can seriously bias interpretations of variation across groups in migration rates and estimated coefficients.

Presence of Children Depresses Moving Probabilities

One obvious conclusion to draw from the estimates is that presence of children in a family most certainly affects mobility behaviour. Out of the 16 coefficients linking number of children to mobility in table 4, 11 are significantly negative. I.e. children reduce the probability of out-migration. A second observation is that the dependency between mobility and presence of children differs somewhat between Norwegians and Asian. Also Schaake *et al.* (2010) find that out-migration is negatively affected by presence of children in a family. In their specification, it is not possible to identify whether children affect out-mobility differently for different country backgrounds.

In order to illustrate the magnitude we calculate how the probability that a family moves out of their 1998-neighbourhood before the end of 2005 changes if we add a child that is eight years old in 1999. For the Norwegians in the western and the northeastern districts the decline in the moving probabilities are 13.5 and 6.5 percentage points. The decline for the Asians are smaller, with respectively 3.3 and 2.3 percentage points. All these changes are significantly different from zero.

Next, we consider the changes associated with very small children. We add a newly born child to the households in 1999. One reason to expect a different effect of this is that up to the age 4-5, children are less attached to their neighbourhood. Even though the coefficients for number of children 6 years or younger is significantly negative for Norwegians in the west and Asians in northeast, the magnitude is rather small (1-2 percentage points). Norwegians in the northeast stand out with a significantly positive coefficient. Having a baby in 1999, decrease the probability that the family stays in their 1999-neighbourhood in 2005 by 4.3 percentage points. The year 2005 coincides with the time when the 1999-baby starts her schooling.

Neighbourhood Mix, Country Background

In the introduction, we referred to the public debate of increasing shares of non-Western immigrants in the North-eastern part of Oslo, and the fear that this can lead to white flight and as a consequence, rapid change. This has to do with the inhabitants of Asian and African origin. From the estimation results, we note that the coefficients for share of Asians and Africans is insignificantly different from zero in the west, while they show a significant pattern in the northeast. If the share of Africans in the neighbourhood is increased by 50 percent the aggregate out-migration of Asians in the northeast increases by 3.2 percentage points, over the period from1998 to 2005. If we, on the other hand increase the share of Asians by 50 percent, the out-migration decreases, but only by 1.6 percentage points. Hence, there is no clear sign of any strong desire to stay in a neighbourhood with your own kind as hypothesised by e.g. Zhang (2011).

In the northeast the propensity for Norwegians to move out of their 1998-neighbourhood is significantly increasing in both the share of Africans and Asians. If we increase both these two shares by 50 percent, the out-migration up to 2005 increases from 54.1 percent up to 57.1 percent. A significant, but not a dramatic effect. Note that estimated coefficients for Norwegians in the West, of shares of Africans and Asians in are quite similar to those in the Northeast, but they are not significantly different from zero.

In a study of migration in Stockholm, Andersson (2013) finds that there was no greater propensity of Swedes to move out of areas experiencing rapid increase of immigrant density. Similar findings are reported by Bråmå (2006). Using survey data find that an increase of the share of non-western immigrants increases the probability of expressing an intention to move (Feijten & van Ham, 2009). Studies from the US on the other hand, e.g. Galster (1990) and Boustan (2010), find clear signs of white flight.

Thresholds, nonlinearities - an informal test

In the US-literature on neighbourhood change, the phrase tipping points is frequently used, Wolf (1963) and Card *et al.* (2008). We find an insignificant effect of shares of Africans and Asians in the district with low shares and a significant positive, albeit weak, effect on out-migration in the district with high shares. These two observations together can indicate that there are non-linearities in the effect, i.e. that out-migration is stronger affected by variations in the share of Asians and Africans at a high level than at a low level. We test for this by testing out various splines. Linear splines are hypothetical break points where effects above and below are allowed to vary.

In the northeast district, the median African-Asian share (A) is 20 percent. Using this as a candidate break point, we estimate the linear effect on the log-odds ratio to be $\beta * A$ if A is below 20, if A is above 20, the effect is estimated to $\beta * A + \gamma * (A - 20)$. When we use 20 as a candidate break point in this way we find an estimated γ-value that is (insignificantly) negative. Furthermore, the overall fit of the estimated model (measured by the Loglikelihood) does not improve when the spline term is included. The same results arise if we test at the upper and lower quartiles (10 and 27 percent) as break points. Hence, there is no evidence of a tipping point, beyond which out-migration of Norwegians accelerate as the share of Asians and Africans increases.[5]

[5] Detailed estimation results are available at request.

At first glance the results seems to contradict US-studies that find an accelerating white population loss as minority shares increase (Galster, 1990; Denton & Massey, 1991; Card *et al*., 2008). We find a weak and non-accelerating correlation between share of Asians and Africans and out-migration of Norwegians. The differing results may stem from real differences, but not necessarily as non-accelerating out-migration and accelerating white population loss can co-exist.

Selective Out-Migration and Changing Social Mix

People care about their neighbourhoods, and they care about with whom they share it. Policy makers care because they care for the well-being of people and because they fear negative spirals of self-enforcing neighbourhood decline. There is also concern for negative effects on social cohesion should a city become to divided, socially or ethnically, and the possible effects of this.

From our estimations, we see that out-migration of Norwegians correlates significantly with the share of Asians and Africans in the neighbourhood. The magnitude is, however, so small that it is not reasonable to see this as an increasing social divide between neighbourhoods. This is supported by the findings of Friedrichs *et al.* (2014) who demonstrate that most measures indicate a stable degree of segregation of migrants in Oslo over the last 20 years, even though we have had a strong increase in the number of people with a Non-Norwegian country background over the same period.

Neither share of university educated nor the median income level in the neighbourhood have any significant effect on out-migration. The share of persons with low-income in the neighbourhood increases the out-migration of Norwegians in both districts. The magnitude of this effect is, however, quite small. Hence, no identified neighbourhood characteristics generate high residential turnover.

Knowledge on the processes that yield stability (survival) and out migration from neighbourhoods could inform policies that encourage stability and social mix. Even if our paper is not directly policy targeted, we would like to point towards two conclusions that are relevant for policy purposes. Firstly, families with (quite small) children represents a source of stability in neighbourhoods. In order to benefit from this potential it is of crucial importance that central authorities takes measure to ensure that school quality do not differ to much within a urban landscape. Secondly, policy measures should not be explicitly targeted towards combat of white flight, as there is very limited evidence of this phenomenon. From the literature reviewed, we can also say that this is the case also in Sweden and in the Netherlands. It is fair to say that we do not interpret our findings as providing special warning signals for the development of social mix in the neighbourhoods of Oslo.

Concluding Remarks

This paper utilises a large-scale register based longitudinal data set with annual information on residents, to analyse time patterns of neighbourhood survival. Utilising such a rich data set allows us to gain insight in the broad patterns. The two most important findings are that the family phase and children are the strongest predictors of out-mobility and that the data do not support any claims of white flight being a driver of change in the Oslo area. Neither of these are very different from what has been found in the literature earlier. It may be said that this very limited support for a white flight hypothesis stands in contrast to the American literature, but not to the European one.

The prime driver of out-mobility is family size and composition. Presence of children in a household significantly depresses the probabilities of moving out of a neighbourhood. This effect is especially strong for children families aged 6 to 11 years old – a period of life where the close neighbourhood plays a most important role in their everyday life. Hence, it seems that normal life course mobility dominates the propensities to stay in and to move out of neighbourhoods in Oslo.

A significant effect of the share of Asians and Africans on out-migration of Norwegians in the most immigrant dense areas and no significant effect in the least immigrant areas, led us to test for any tipping-, or break points. These estimations failed to find any accelerating effect, and hence, no tipping points.

Through a set of tests of models nested within each other, we find that disaggregated models for Norwegians and Asians and for the different areas studied perform far better than a pooled model. I.e. an assumption of equal coefficients across groups and location is rejected, at any sensible level of significance. This an important reminder for empirical analysts, as it is quite common to capture differences between groups by including dummy-variables and estimating models on total samples. At a substantial level, this is also an important empirical finding as it implies that the drivers of out-mobility differ across location and country background. Related results has been found by Schaake *et al.* (2010).

The analyses in this paper is broad and we most certainly regard it as justified to describe the paper as macroscopic. This bird's eye perspective, combined with a very rich data set, makes it possible to identify the broad patterns with a high level of precision. There are nevertheless important aspects of individual level mobility that we do not capture with our macroscopic approach. There are two specific aspects in this regard we would like to point to.

We have established that there is no particularly strong association between immigrant density and out mobility of the majority. Furthermore, there does not seem to exist any aggregate tipping point. We have not addressed the question of whether there is a point at which out-mobility of some particular groups of Norwegians accelerate. E.g. are some groups within the majority more sensitive for immigrant shares when it comes to tipping and flight-like behaviour. This should probably be handled in a modelling frame allowing for a rich set of interactions, e.g. a linear probability model. Second, an intra-neighbourhood move is not only a move out of a neighbourhood, it also a move into a neighbourhood. An analysis of how mobility changes neighbourhood characteristics of those who move, under different circumstances and conditions, would extend the empirical insights of this paper. We would like to think about our paper as a frame for such more focused and specialised studies.

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