

**Ethnic segregation
in housing, schools, and neighbourhoods
in the Netherlands**

Cover picture '*Tulips in black, white, and many shades of grey*' by Renée Prevoo

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DISSERTATION

to obtain the degree of Doctor at the Maastricht University,
on the authority of the Rector Magnificus Prof. dr. L.L.G. Soete,
in accordance with the decision of the Board of Deans,
to be defended in public on Friday, 14 November 2014 at 12:00 hrs.

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Acknowledgements

Shortly before the start of the 20th century, my great-grand parents joined the historical wave of Chinese emigration and ventured to what was then British Malaya as low-skilled economic migrants. They were different from previous cohorts, the *Peranakan* or Straits Chinese, who came educated, in smaller numbers, and inter-married with the locals while adopting local customs. When the Federation of Malaya gained its independence in 1957, roughly half of the population consisted of ethnic minorities of migrant background. Ethnic segregation was a collective reality inherited from the British ‘divide and rule’ colonial policy, later sustained and reinforced by the post-independence political and educational structures. One’s choices in peers, schools, neighbourhoods, and (ethnic-based) political affiliation became unremitting conscious acts of integration or segregation. And so it was, the seed of my PhD research, sown long before I was born.

As an ‘*allochtoon*’ with smattering knowledge of Dutch, it was my privilege and pleasure to be able to dedicate my research entirely on one country that was not my own: the Netherlands. Reading my first-year notes, I was struck by how close my final thesis came (despite the long detour) to resemble my original ideas for a PhD project (e.g. looking at preferences from two different modelling frameworks: hedonic pricing and discrete choice). This reveals, to a large extent, the level of flexibility and trust offered to me by my supervisors, Henriëtte and Kristof. An experienced ‘*promotor*’, Henriëtte had deftly provided the much needed direction and structure to the PhD project. Memorable wise words include (paraphrasing Faulkner), “you must learn to kill your darlings” when commenting on my verbose first drafts. With Kristof, I discovered that research was best learned by doing. I was trained to write academic papers next to more specific skills such as nonparametric estimation methods, but most importantly, I learned to trust my own skills and knowledge as a researcher. Henriëtte and Kristof, completing this thesis would not have been possible without your steadfast support and guidance.

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sandwiches, coffee, and even summer peaches) to look beyond my PhD topic for future avenues of research and policymaking.

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Contrary to the oft-described solitary PhD experience, I was never alone from Day One. It was a blessing to have started this PhD journey with six wonderful companions (and their spouses). Along the way, I have found other 'kindred spirits' – each special in their own way and had so much to offer, individually and collectively. We bonded over chai, shisha, Turkish brunches, international dinners, Café Zondag drinks, coffee corner breaks, weddings, baby showers, Facebook, Whatsapp, rowing, travels, and the many events (Carnaval, Meet & Greet, Nowruz, PhD Academy, Queen's Day, ...) the cities of Maastricht and Amsterdam and their diverse communities had to offer. The PhD being an all-encompassing endeavour, its woes naturally spilled over to other spheres of life – I was lucky to have sympathetic housemates and friends with (almost) inexhaustible patience (!). With all variants of today's social media, some were always there without actually being there. Thank you all for being generous to me with your time, home, nourishment, and love.

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I dedicate this thesis to my family: my parents who have been with me on this journey in so many more ways than they realise, my siblings (in-law) who made up for my absence and helped bridged the distance, my young nephew who taught me (along with other young, special ones ☺) that life's biggest joys come in small packages... I hope to have made you all proud.

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Cheng
"Sjeng"
静

Maastricht, 2014

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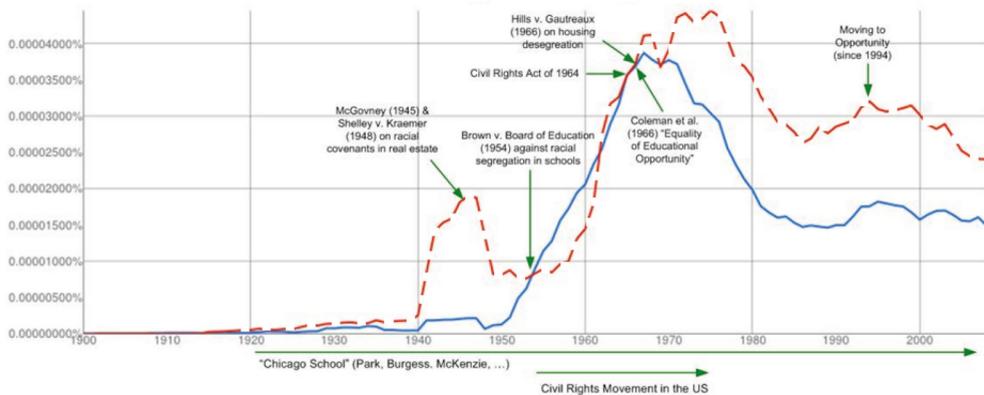
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1. General Introduction

1.1. The rise and fall of 'segregation'

Whether deliberately organised, or an outcome of *'the interplay of individual choices that discriminate'* (Schelling, 1971, p. 143), segregation of people by gender, ethnicity, religion, socioeconomic status, and the rest manifests itself in various public spheres such as workplace, schools, and neighbourhoods. Like many other phenomena, the interest in 'segregation' has waxed and waned over time. Figure 1.1 plots two density distributions of book counts where 'residential segregation' or 'school segregation' have been recorded as a proportion of all Google-digitised books in English from 1990 to 2008 (Google Books Ngram Viewer, 2012).

Figure 1.1: Rise and fall of segregation concepts



Source: Google Books Ngram Viewer (2012), adapted with author's own interpretation of historical events and major research that can be linked to the use of segregation concepts. Graph indicates the density of book counts where segregation concepts have been recorded as a proportion of all Google-digitised books in English from 1990 to 2008. Solid line represents 'school segregation' while dashed line represents 'residential segregation'.

The rise in segregation research coincided largely with the socio-legal development for racial equality in the United States (*Brown v. Board of Education*, 1954, *Hills v. Gautreaux*, 1976, *Shelley v. Kraemer*, 1948; McGovney, 1945). Leading up to that, there were the seminal work from the 'Chicago School' of sociology in the 1920s (Burgess, 1928; Park et al., 1925) that had first mapped migrant settlement in cities and established socio-spatial theories to the emerging and changing patterns. Influential writings by the likes of Gunnar Myrdal (1944) with his book, *An American Dilemma: The Negro Problem and Modern Democracy* brought to light the moral imperative in addressing racial segregation. The quest for racial equality

culminated in the anti-discrimination Civil Rights Act of 1964 which interestingly, had a parallel (albeit much weaker) development across the Atlantic in the form of the British Race Relations Act 1965. As 'segregation' emerged as a field of interest, methodological tools were developed to measure segregation (e.g. Duncan and Duncan, 1955; Taeuber and Taeuber, 1965). So did theoretical models that sought to explain the dynamic factors of segregation (Schelling, 1972, 1971).

Scholarly work in residential and school segregation then declined before the short spurt in the second-half of the 1990s. The latter could be linked to the many urban regeneration policies, e.g. the European Union's URBAN programme that had targeted socially excluded city neighbourhoods (CEC, 1994; GHK, 2003), and the public housing voucher programme in the United States, 'Moving to Opportunity' (Kling et al., 2005). Notably, the socioeconomic factor in segregation has finally gained eminence as policymakers agree on the adverse social effects of concentrated poverty.

While all the causes and effects of ethnic segregation are too numerous and eclectic for the domain of one dissertation, this thesis narrows down the research scope to focus on three main themes: preferences for peer composition, nonlinear dynamics in peer composition, and peer effects of segregation. Based on the neoclassical economics approach, it focuses on the role of preferences in driving ethnic segregation processes. In addition, it explores if and how public policy can mediate these preferences in order to influence segregation outcomes. Using rich administrative and survey data, the thesis addresses the following research questions:

- Do native Dutch and non-western minority homeowners have different preferences for their own neighbourhood's ethnic composition?
- Do students prefer schools with more peers of their own ethnic and socioeconomic background?
- Does ethnic peer composition at the primary school-level have a long-term effect on one's likelihood to drop out of high school?
- Did some neighbourhoods in Dutch large cities experience large residential turnovers to become hyper-segregated neighbourhoods?

It is also centred on Western Europe – with the Netherlands as a country case study – where states have been inadvertently transformed into 'immigrant nations' in the recent decades.

1.2. 'Immigrant nations'

Continuous influx and settlement of immigrants, especially those of non-European ancestry, have led to the transformation of West European¹ nation states into 'immigrant nations' (Scheffer, 2011). The advent of mass immigration after nation building sets these countries apart from traditional countries of immigration such as the United States where immigration was part and parcel of nation building². Several channels of immigration have led to this phenomenon: labour migration, family reunification and formation, and asylum migration. As a secondary effect, immigration also feeds the population boom of second- and third-generation migrants in the region.

Labour migration

Immigration was originally conceived by West European governments to be temporary in nature, as made explicit in the 'guest worker' bilateral labour agreements that addressed low-skilled labour shortages. Former colonial empires like France and the United Kingdom also relied on labour immigrants from the (former) colonies. This lack of foresight had precluded critical consideration on the long-term 'fit' between the immigrants and the receiving nations, nor any skill prerequisites beyond what was necessary for low-skilled employment. The latter is in contrast to Canada's pioneering 'points system' in 1967 targeted at highly skilled immigration which has since been mimicked by Australia (1989), New Zealand (1991), United Kingdom (2008), and Denmark (2010). Discriminatory gate-keeping measures based on race and country of origin were also not uncommon in the past, e.g. pre-1967 Canada with its "continuous voyage" regulation to bar Indian immigration in 1908 and the 1923 Chinese Immigration Act (King, 1908; Triadafilopoulos, 2013). Singapore still employs implicit measures aimed at maintaining its existing ethnic Chinese-dominant racial mix (Vasu, 2012).

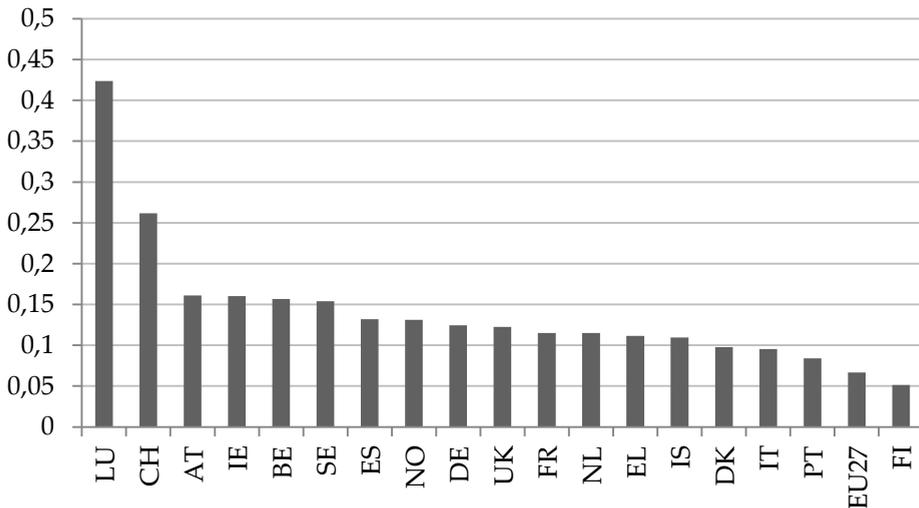
That most of the 'temporary' migrants were here to stay turned into an inevitable fact. West European societies had a relatively shorter time span to come into terms with its transition from net emigration countries to 'immigrant nations'. The most recent migrant stock data in Figure 1.2 shows that on average, one out of seven inhabitants in a West European country is foreign-born. This ranges from a low 5 percent in Finland, a country with traditionally restrictive immigration policies, to

¹ 'West European states' are defined geopolitically as the European Union 15 (EU-15) countries prior to the 2004 enlargement – Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, United Kingdom – and the European Free Trade Association (EFTA) member countries – Iceland, Liechtenstein, Norway, and Switzerland – that operate alongside the European Union.

² The 'homogeneous' nation state building view has been disputed by the likes of Castles and Miller (2009) who argue that the role of immigrant has been largely overlooked in pre-1945 European history, most notably in France (see Noiriel, 1988).

a very high 42 percent in Luxembourg, a small and affluent economy reliant on foreign labour. The Netherlands has a slightly below (West European) average share of 11.5 percent foreign-born inhabitants in 2013. The relative low average proportion of foreign-born population among the 27 European Union countries is due to the lower ratios in the new member countries in comparison to Western Europe.

Figure 1.2: Foreign-born population as share of total population, 2013



Source: Own calculation based on Eurostat (2013).

Family reunification and formation

A defining constraint faced by most West European governments is the ‘free movement of persons’ pillar of the European Union (EU) Single Market. European Community Law (1961, Regulation No. 15) enshrines one’s right to family reunification. The far-reaching implications of the EU directives were underestimated as pointed out by Groenendijk (2006) and national governments had to limit or retract tighter immigration controls, e.g. the 120 percent minimum wage requirement that was (later unsuccessful) imposed by the Dutch government in 2004. For most of Western Europe, family migration through reunification and marriage grew into the dominant stream of legal immigration when demand for low-skilled foreign labour subsided from the 1970s oil crisis (Kraler, 2010). In 2006, 44 percent of immigration by status of entry was family-related (not including the 9 percent of the migrant workers’ accompanying family) compared to 14 percent of labour immigration for the Organisation for Economic Co-operation and Development (OECD, 2008a). Without work and skills requirements, adult family migrants were usually worse fitted for integration into their host societies. The trend of marriage migration among citizens of migrant descent can be perceived as

a step backwards for integration as they fuel chain migration and '*a permanent growth of groups of ethnic minorities in a situation of deprivation*' (Bonjour, 2008; based on the debate in the Dutch House of Representatives, Tweede Kamer, 2004a). Yet, the long political denial of this changing demographics resulted in the pre-1990s absence of integration policies (c.f. Zincone et al., 2011).

Asylum migration

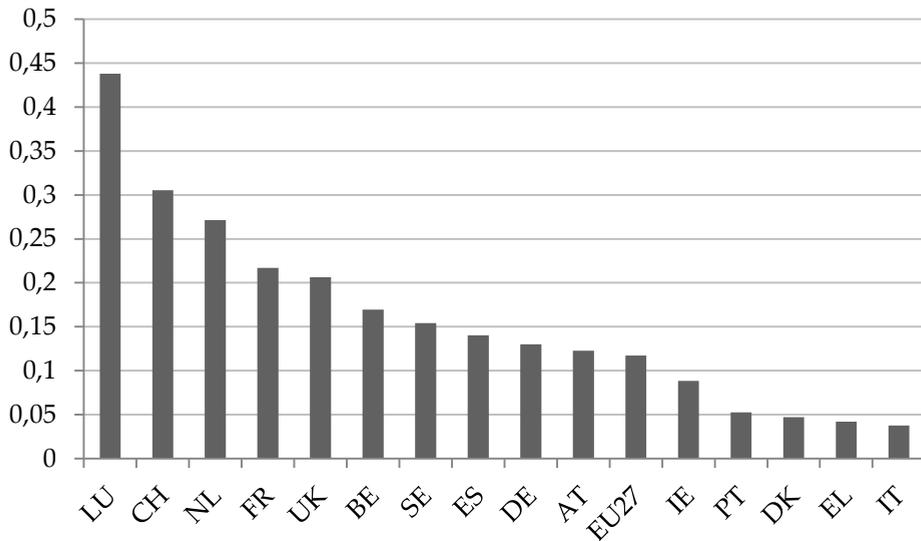
The 1980s saw a surge in global asylum migration that peaked in the early 1990s prior to the tightened asylum regulations (UNHCR, 2001). At present, Sweden leads Western Europe with its relative refugee population of 9.9 refugees per 1,000 inhabitants followed by Norway (8.8), Germany (7.1), Switzerland (6.5), Austria (6.2), and Luxembourg (5.7) while Portugal tails behind with 0.05 refugees per 1,000 inhabitants (UNHCR, 2012)³. Small in numbers compared to other types of migrants, settled refugees have the multiplier effect of contributing to chain migration via family-related migration. They are also a highly heterogeneous group of many nationalities and diverse motivations of asylum and socioeconomic background which complicate some of their integration experience in the receiving societies.

Second-generation migrants

Amid immigration restrictions over the past decades, the population of migrant background in Western Europe flourished with family migration and babies born to migrant parents. This is reflected in the higher share of youth aged 15 to 24 years being of second-generation migrant background in Figure 1.3 compared to the share of foreign-born population in Figure 1.2. In countries like France and the United Kingdom, roughly one in five youths are now of second-generation migrant background (a significantly higher statistic is expected if third-generation migrant youths were included). This figure is higher in Netherlands with one in four youths being of second-generation migrant background. The fertility trend is equally striking, e.g. a quarter of the babies born in England and Wales in 2012 were born to mothers who are not from the United Kingdom, more than double the proportion from a decade earlier in 1992 at 11.9 percent (ONS, 2013). Hence, the present population of migrant background in Western Europe is expected to increase even without further labour immigration.

³ These numbers masked the larger immigration quandary of pending or rejected asylum-seekers and unreported illegal migrants.

Figure 1.3: Share of population aged 15-24 being second-generation migrant, 2008



Source: Own calculation based on Eurostat (2008). The definition of 'second-generation migrant' here refers to one born in the reporting country with at least one foreign-born parent.

1.3. From immigrants to citizens

Perceived and real differences

In Western Europe, the issue at stake has gone beyond immigration control to the integration of those of migrant origin in their respective societies. Here, contradictions with earlier recognised minority rights that were enshrined in the Council of Europe's Framework Convention for the Protection of National Minorities become apparent (Council of Europe, 1995). Politically, European nation states have struggled with the distinction between 'minorities' covered under the Convention and 'migrants' that are afforded less recognition and fewer rights (Sasse, 2005; for the Dutch example, see Eerste Kamer der Staten-Generaal, 2004). This is especially so with the awarding of citizenship to 'migrants' who were born in their host countries or have resided there for a sufficient duration of time. Both groups grapple with common challenges in relation to the host or dominant group while seeking equality in group-based recognition and rights. Yet, the status quo of differential policies has created a hierarchy of status between the 'national minorities' or 'old minorities' and the 'new minorities'. 'National minorities' can be indigenous to the country, e.g. Bretons and Corsicans in France, or of migrant origin, e.g. the Roma communities in Austria, Norway, and Sweden. Although 'new minorities' allude to their more recent 'arrival' and typically refer to post-war immigrant groups, a concrete definition of 'new minorities' remains elusive and subject to the national interplay of history, socioeconomic, and political dynamics

(e.g. Sasse and Thielemann, 2005 and the Journal of Common Market Studies' Special Issue on "Migrants and Minorities in Europe", 2005). Within the confines of this chapter, the discussion concerning 'new minorities' is limited to West European citizens of post-war, non-European migrant origin.

The integration of 'new minorities' has been by and large problematic, barring several exceptions such as the Dutch citizens of Indonesian descent⁴. The main obstacle is the perceived dissimilarity with previous immigrant cohorts of European descent who have been successfully assimilated (Sides and Citrin, 2007). This perception could be mutual, judging by the relative low levels of intermarriage between non-European immigrants of non-Christian religions and members of the host societies (Lucassen and Laarman, 2009). Scholars like Charles Tilly (1975) defend the specificity of 'Western Europe', which he argues had, by 1500, achieved a distinguishable level of cultural homogeneity with legal-political, linguistic, economic, demographic, and religious commonalities forged by the Roman Empire. The later state- and nation-building phases bounded the concept of 'nation'⁵ to the citizenship of a territorial state (Rokkan, 1975; Tilly, 1975). It is imperative to point out that ethno-cultural homogeneity was a lasting legacy, rather than the cause, of the historical, elite-driven nation-building process⁶. Wilpert (1993; as cited in Pettigrew, 1998) illustrates this dominant ethno-centric view with the German example of '*Aussiedler*' or people of German-descent from the former Soviet Union and Poland who 'returned' to Germany under full citizenship rights while German-speaking third-generation Turks (prior to 2000) were denied citizenship. The non-Christian faiths of the 'new minorities' are also singled out by some of the religious majority Christians who prefer to maintain Western Europe's Christian identity and secularists who believe in the separation of church and state and are against religion in the public sphere. The French ban on headscarves in public schools and the 2009 Swiss referendum to prohibit the construction of minarets on mosques serve as vivid examples. In addition, most of the 'new minorities' are 'visible minorities' – i.e. borrowing from the Canadian concept, '*persons who are non-Caucasian in race or non-white in colour*' (Statistics Canada, 2011) – who are susceptible to overt and covert racism and discrimination.

Besides presumed lack of 'cultural fit', the 'new minorities' tend to occupy and remain within the lower strata of West European societies. This is attributed to the circumstantial and historical mix of low-skilled labour immigration, heterogeneous

⁴ This is reflected in their exclusion from the 'non-western minority' definition under Dutch population statistics (Alders, 2001, see also Subsection 1.7 in this Chapter).

⁵ This follows Hobsbawm's definition of the 'nation' as '*the body of citizens whose collective sovereignty constituted them a state which was their political expression*' (1990, pp. 18–19).

⁶ Half of the French 'nation' did not speak French at all in 1789 or that only 2.5 percent of Italians used Italian as an everyday language at the time of unification in 1860 (Hobsbawm, 1990).

asylum migration, and family-related chain migration. Social mobility of native-born second-generation migrants – conditional to multiple factors such as parental resources and national contexts – has been slow and patchy for most (Albertinelli et al., 2011; Crul and Vermeulen, 2003; OECD, 2012). The lack of social-spatial mobility has led to the development of migrant ethnic enclaves in European cities (Kesteloot and Cortie, 1998; Musterd, 2005; Sager, 2012). Ethnic segregation became a fundamental issue to policymakers due to four key reasons: inequality, social cohesion, peer effects, and neighbourhood decline (see Massey and Denton, 1993). Firstly, inequality is less tolerated under the ‘welfare-state regimes’ (Esping-Andersen, 1990) yet it persists between natives and the ‘new minorities’ over generations. The gap between the two groups could either be an indicator of the lack of integration of minorities or the discrimination faced by them that hinders equal access to housing, education, politics, and the labour market. Living, schooling, and working apart – whether voluntary or involuntary – reduce the social interaction between the groups and prevent the acculturation of migrant households, e.g. with the acquisition of language skills.

Increased inter-group interaction however, does not automatically improve social cohesion as it could increase ethnic tension and group conflict for resources such as housing and work (Scheepers et al., 2002). Nonetheless, the concentration of underprivileged minorities in schools and neighbourhoods allows for possible ‘peer effects’, e.g. a migrant youth’s probability of truancy increases if the behaviour was prevalent among her peers. Neighbourhood decline can be expected if better-off households choose to leave the neighbourhood – a trend which saw to the creation of black ghettos in the United States after the departure of middle-class black households (Wilson, 1987).

Socio-political backlash

As Western Europe grapples with the demographic change and increasing social inequality, state governments faced the socio-political backlash from two fronts: the anti-immigrant native population and the marginalised youths of migrant descent. The former anti-immigrant sentiment underlay the rise in populist far-right political parties as a response to the increased migration inflows of the 1980s and 1990s⁷ (see for instance Penninx, 2006). Mudde (2007) identifies nativism (which encompasses opposition to immigration), authoritarianism (opposition of transgressions against authority), and populism as the common denominators of

⁷ Much of the discourse on immigration and naturalisation in Western Europe had recurred at earlier points of history for some countries, e.g. the adverse effect of a large and continuous supply of low-paid migrant workers on the welfare of American-born workers discussed in Frank Julian Warne’s book, *The Immigrant Invasion* (1913).

these parties. Despite occasional electoral successes, they were largely excluded⁸ from executive power via the (implicit) *cordon sanitaire* or exclusion by mainstream parties for coalition formation, e.g. the fate of the then *Vlaams Blok* in Belgium. Even so, their electoral successes did indirectly bring about their desired policy outcomes with mainstream parties co-opting (to a lesser degree) their policy agenda on immigration and integration (Mudde, 2013; Pettigrew, 1998).

On the other extreme, there was the disenchantment of marginalised youths of migrant background that manifested in civil disorders. Notable examples being the 2001 Oldham-Burnley-Bradford chain riots in England and the 2005 suburban or '*banlieue*' unrest in Paris. Issues of parallel communities, racism, unemployment, and police violence mirror those of the United States race riots in the 1960s. The major finding of the unrest by the United States National Advisory Commission on Civil Disorders (Kerner Commission, 1968) could be prophetic for West European nations: '*Our nation is moving toward two societies, one black, one white – separate and unequal*'.

1.4. European comparative research on ethnic segregation

Alongside the socio-political development of West European societies into immigrant nations described in the previous section, corresponding research has also been advanced during this period. The last two decades witnessed an unprecedented, large-scale collaborative international research on immigration, social cohesion, social-spatial exclusion of migrants, and the integration of second-generation migrant youth (Crul et al., 2012; Heckmann and Schnapper, 2003; "IMISCOE," 2013; Kraler, 2010; Musterd and Murie, 2002). The availability of comparative quantitative data has also fuelled this angle of research in ethnic segregation (e.g. Albertinelli et al., 2011; Levels et al., 2008; OECD, 2012). After a pioneering Eurostat pilot study of common indicators for measuring migrant integration in 2011, more studies are expected in the coming years under the 2004 Hague Programme to '*develop clear goals, indicators and evaluation mechanisms in order to adjust policy and evaluate progress on integration*' (Eurostat, 2011).

Across West European countries, their similarities and dissimilarities in equal measure offer a 'quasi-laboratory' setting for examining the interplay between national policies, migrant group characteristics, and the resultant integration outcomes. The distinct 'modes of migrant integration' can be compared, e.g. the 'assimilationist' France compared to the 'restrictive' Germany and Switzerland or

⁸ Some exceptions include Austria's far-right Freedom Party (*Freiheitliche Partei Österreichs*) which formed a coalition government with the conservative People's Party (*Österreichische Volkspartei*) in 2000 (see Mudde, 2013).

the 'multiculturalist' United Kingdom and the Netherlands⁹. Clearly, cross-national studies offer limited but informative comparisons. Crul and Vermeulen (2003) for example, compared the labour market and educational integration of second-generation ethnic Turks in six West European countries with sizeable Turkish communities: Sweden, Germany, the Netherlands, Belgium, France and Austria. They conclude that despite the higher proportion of second-generation Turkish youths entering lower vocational schools in Germany and Austria, the apprenticeship system smoothes their transition into the labour market. Their counterparts in France in contrast are more likely to be in preparatory school for higher education but face higher risks of school dropout or unemployment. Similar conclusions were found in a separate study comparing a larger set of migrant-minority groups and countries (Heckmann and Schnapper, 2003).

The same study using a smaller sample of three countries representing the 'integration regimes' – France, Germany, and Great Britain – also found high levels of acculturation and host country language proficiency with modest discrimination experience among second-generation migrant youths next to evidence of social mobility compared to their foreign-born parents (Heckmann and Schnapper, 2003). The picture is bleaker when one examines the outcome gap between natives and those of migrant background. Migrants remain disadvantaged in employment, education (test scores and early school leaving), income, risk of poverty and social exclusion, and property ownership (Albertinelli et al., 2011; Eurostat, 2011). Such bivariate descriptive statistics are interpreted with caution since migrant status correlates highly with low socioeconomic status in Western Europe. Controlling for socioeconomic and socio-cultural factors such as parental education and number of books at home, children of migrant background still lag behind in reading skills, especially if they speak a different language at home (Marks, 2005). Further research found discrimination against migrants in the labour market (De Beijl, 2000) which could account for their poorer economic performance.

Overall, scholars in Europe are less pessimistic about the development of an 'underclass' (Wilson, 1987) among their 'new minorities' that is comparable to the African American ghetto community in the United States (Heath et al., 2008; Musterd, 2005). Segregation in Western Europe appears to be most pronounced and persistent in housing and schools (Jenkins et al., 2006; Musterd, 2005) with numerous policies set up as counteracting forces (the Swedish example, see Andersson et al., 2010). This calls for future research – multivariate empirical studies in particular – and the potential for Western Europe to learn from and

⁹ It is crucial to note that integration policies are not static and have shifted considerably over the years, see Joppke's elaboration on the convergence of these policies across Western Europe (2007).

contribute to the wider segregation literature that has been developed in traditional immigrant countries like the United States.

1.5. Ethnic segregation in the literature

From a theoretical perspective, the ethnic segregation literature began from an *ecological standpoint*, see Table 1.1 and the earlier Figure 1.1. The ‘Chicago School’ of sociology in the 1920s (Burgess, 1928; Park et al., 1925) established the field of urban sociology and human geography by socio-spatially mapping the distribution and evolution of migrant groups in the city. They take advantage of biological analogies to describe the ‘invasion’ of migrant groups into specific neighbourhoods, the inter-group ‘competition’ that leads to one’s decline or growth, and so forth. Here, spatial distance between groups is assumed to be symptomatic of their ‘social distance’. As immigrant groups assimilate culturally and economically into the dominant host culture, their propensity to live separately decreases (Alba et al., 1997; Gordon, 1964). Besides the one-way, complete assimilation¹⁰ prophesied by Park et al. (1925), ethnic groups could acculturate to a limited extent, whether by choice or circumstance, and maintain some level of segregation – also known as ‘segmented assimilation’ that has gained dominance in the segregation literature (Portes and Zhou, 1993). The development of new suburban ethnic enclaves by upwardly mobile ethnic groups is a case in point (Alba et al., 1999; Rosenthal, 1960).

The earlier socio-legal development towards racial equality is couched on *institutional theories* of ethnic residential segregation, e.g. McGovney (1945)’s seminal piece detailed the unconstitutional role of state courts in enforcing racial restrictions in housing contracts prior to *Shelley v. Kraemer* (1948). The discriminatory practice of mortgage lending against ‘high-risk’ neighbourhoods – i.e. ‘redlining’ – and households is also a main factor of residential segregation. This was observed in predominantly African American neighbourhoods (Wilson, 1987) and to a lesser degree in minority neighbourhoods of Western Europe (i.e. “yellowlining”, see Aalbers, 2005). At the same time, government policies can be used to weaken segregation tendencies, e.g. ethnic quotas in Singaporean public housing (Wong, 2013). Policy effects however, might not always be intuitive. Wilson (1987) attributes the skimming of middle-class families from predominantly African American neighbourhoods to the equal housing access

¹⁰ This follows Alba and Nee’s general definition of ‘assimilation’ that is, ‘*the decline, and at its endpoint the disappearance, of an ethnic/racial distinction and the cultural and social differences that express it*’ (1997, p. 863). ‘Assimilation’ here is used interchangeably with ‘acculturation’, see Gans (2006) for the difference between ‘assimilation’, ‘acculturation’, and ‘social mobility’ and Gordon (1964, 1961) on the various dimensions and degrees of migrant integration.

provided by the Civil Rights Act of 1964, leaving behind their disadvantaged neighbours.

Table 1.1: Theoretical explanations of residential segregation

Theory	Explanation of Residential Segregation	Key Literature
Ecological	Spatial distance reflects social distance between naturally constituted social groups. Segregation decreases with assimilation of the weaker group.	Park, Burgess & McKenzie (1925); Rosenthal (1960); Gordon (1964); Alba et al. (1997); Zorlu (2009)
Institutional	Segregation can be imposed upon or reduced by institutional agency, e.g. the government, lending institutions and real estate agents.	McGovney (1945); Wilson (1987); Aalbers (2007, 2005); Wong (2013)
Structural	Segregation is either a function to or consequence of the economic, social and/or political structures.	Wilson (1987); Sassen (1998); Massey & Denton (1993); Marcuse (1997a, 1997b); Musterd & Ostendorf (1998)
Neoclassical Economics	Individual housing consumers are distributed across space according to their ability and willingness to pay for housing and neighbourhood attributes.	Bajari & Kahn (2005); Bayer & McMillan (2007); Wong (2013)

Source: Based on the conceptual framework of Kaplan and Holloway (2001).

This top-down view of institutional theories is shared by *structural theories*. Structuralists see economic, social, and political inequalities as reproduced as residential segregation. Earlier literature focuses on the creation of African American ghettos – the extreme segregation outcome when racial discrimination interacts positively with high poverty (Marcuse, 1997a, 1997b; Massey and Denton, 1993). Their post-Fordist experience – shift from manufacturing to low-grade services, high unemployment, welfare dependency, neighbourhood decline, among others – became ubiquitous among the low-skilled, largely migrant, group of today’s polarised global cities (Sassen, 1998, 1991). Unlike earlier migrant cohorts, the new low-skilled migrant cohorts face severe obstacles to social mobility thus impeding their assimilation process. The ‘new minorities’ in Western Europe are especially precarious due to the low starting point when they or their (grand-)parents first entered the country and the adverse effects of economic restructuring (see the West European case studies in Musterd and Ostendorf, 1998).

While institutional and structural theories emphasised the role of external forces, *neoclassical economics* reposition the role of individual or household preferences in driving segregation. Here, individuals are rational, utility-maximising agents with perfect information to realise their preferences within financial constraints. Barring

market restrictions, the demand for the various housing and neighbourhood attributes is capitalised into the housing price. Schools are typically considered a neighbourhood amenity and a determinant of residential location choice (e.g. Bayer et al., 2007). Under neoclassical economic theory, if one assumes that these attributes are not evenly distributed across neighbourhoods, residential segregation could be a reproduction of ethnic and socioeconomic differentials in preferences (c.f. Bajari and Kahn, 2005). With this in mind, one's willingness to pay for specific neighbourhood ethnic composition can be modelled and estimated. Neoclassical economic theory also concurs with the increasing commodification of the housing sector in Western Europe (e.g. see Murie, 1998 for the United Kingdom; and van Kempen and Priemus, 2002 for the Netherlands). Based on this insight, this thesis applies the neoclassical economics framework to a West European case study. The latter is expedient since ethnic segregation studies using this approach are few and far between (also noted by Durlauf, 2004 in the study of neighbourhood effects) and limited to North American cities (Bajari and Kahn, 2005; Bayer and McMillan, 2008; for an exception, see Wong, 2013)

The following literature subsection elaborates more on (i) preferences for housing, schools, and neighbourhoods before discussing the (ii) nonlinear dynamics in school and neighbourhood composition that could result in segregation outcomes. Finally, it reviews the key literature on the (iii) compositional effects of segregation.

1.5.1. Preferences for housing, schools, and neighbourhoods

Ethnic segregation has many causes, one of which is the heterogeneity in preferences (Bajari and Kahn, 2005; Bayer et al., 2007). Assuming that the spatial distribution of dwellings and people is not even across neighbourhoods, segregation occurs if social groups prioritise distinct housing or neighbourhood attributes, including neighbourhood composition. Starting from the individual and her cognitive processes, psychologists study the reasons behind human beings' tendency to group themselves and when doing so, develop in-group favouritism and out-group hostility (Tajfel and Turner, 1979). Social preference does not necessarily extend to those of the same kind, e.g. parental choice for schools with good students regardless of the ability of their own child. They may wish to benefit from the positive externalities associated with the group (termed "social capital" by Coleman, 1988) or to 'signal' their own desirability via their group membership (Veblen's "conspicuous consumption", Veblen, 1934).

More often than not, this preference is heterogeneous, conditional to the household's own characteristics. For instance, ethnic minority households could favour living in neighbourhoods with co-ethnic concentration to take advantage of

cultural-specific goods and services (Aldrich and Waldinger, 1990). Equally, they could favour living with native population households as a symbol of acculturation – more so if they choose to be homeowners too (Alba et al., 1999; Alba and Logan, 1992; Logan et al., 2002; Massey, 1981; Park et al., 1925). To estimate unbiased preferences, flexible nonparametric methods (c.f. Bajari and Kahn, 2005) and discrete choice methods (Bayer et al., 2007) have been suggested in the literature.

Next to heterogeneous preferences, housing and school are also ‘composite’ goods that are made up of many utility-deriving characteristics. This includes ‘locality-specific’ attributes such as public safety, crowding, pollution, composition of peers, and proximity to amenities. In other words, households jointly choose over these characteristics, simultaneously deciding on housing type, neighbourhood type, and if they have school-age children, school type. Evidence of individual household’s micro preference for the characteristic composition of their neighbours and peers is conclusive, both in terms of stated preferences (Bobo and Zubrinsky, 1996; van der Laan Bouma-Doff, 2007) and ‘revealed’ preference by means of actual choice data or effects on housing price (Bayer et al., 2007; Zorlu and Mulder, 2008). The benefit of revealed preference research is that it accounts for: (i) the bias of survey respondents towards ‘socially accepted’ answers, (ii) the ‘bundling’ nature of school or housing characteristics that needs to be trade-off with one another, and (iii) the constraints of regulations and allocation policies (among others, see Allen and West, 2009; Baranzini et al., 2008; Schneider et al., 2006).

In contrast to residential location choice, first-grade enrolment school choice is subject to matching principles (c.f. the student assignment mechanism literature by Abdulkadiroğlu and Sönmez, 2003; Hastings et al., 2005). Besides prohibitive school fees, schools could have admission policies that allocate the potentially scarce places based on proximity to residence, sibling’s enrolment, religion, lottery, and so forth. Hence, a school choice study based merely on actual school enrolment would be misleading. One could however exploit other forms of ‘revealed preferences’ within school mobility over the course of education (Cameron and Heckman, 2001; Declerq and Verboven, 2013).

1.5.2. Social interaction of preferences and nonlinear dynamics

When it becomes clear that households do possess quite varied preferences on housing, neighbourhood, and school attributes, the next questions would be: how do these preferences socially interact with one another and what are the outcomes of these social interactions? If individuals have a specific tolerance or preference in peer composition then even one individual’s move could tip the racial or socioeconomic balance, leading others of similar kind to move out. An artefact of

North American segregation discourse, this phenomenon is defined as 'white flight' (Boustan, 2010; see also Coleman et al., 1975; first mentioned in Grodzins, 1958). Despite its geographical origin, 'white flight' research is picking up in Western Europe with its rising migrant population (Mocetti and Porello, 2010; Rathelot and Safi, 2013). However, 'white flight' is a misnomer when used to study ethnic composition turnovers as it incorporates the phenomenon of 'white avoidance', i.e. 'white' households avoiding areas with high share of 'non-whites' when relocating (Ellen, 2000). Any compositional change would depend on the numbers and characteristics of the 'out-movers', 'in-movers', and 'those remained' (Galster et al., 2000). In any case, nonlinear dynamics in peer composition is the expected outcome if these social interactions have an endogenous or 'social multiplier' effect (Becker and Murphy, 2000; Schelling, 1971). 'Tipping point' or nonlinear dynamics in peer composition can also be seen as a discontinuous and endogenous effect of a gradual change in ethnic composition on the overall ethnic composition (Card et al., 2008a; Easterly, 2009). This discontinuous effect could also apply to another variable of interest, also known as a 'contextual tipping point', which is explained further in the next subsection.

1.5.3. Compositional effects of segregation

Once the causes of segregation are ascertained (e.g. heterogeneous preferences and social interaction effects), 'peer effects' on individual behaviour is the natural progression of segregation research. 'Peer effect' studies tend to revolve around children and adolescents because of the larger significance of the social environment (c.f. "ecological theory of human development" in Bronfenbrenner, 1989) and its long-term effects on their critical cognitive and interpersonal development (e.g. Chetty et al., 2011; Reynolds et al., 2001). It is not surprising that the main social environments used to study the dynamics and effects of ethnic composition are neighbourhoods (Card et al., 2008a; Kling et al., 2005; Overman, 2002; see the review in Durlauf, 2004) and schools (e.g. Clotfelter, 1976; Gould et al., 2009) where children spend most of their time and develop influential peer groups. Neighbourhood peer effects could also entail the intergenerational transmission of social inequality (Borjas, 1995), e.g. youths brought up in poor neighbourhoods would end up being poorer in their lifetime earnings compared to those who had lived in richer neighbourhoods.

Often outcome events such as teenage pregnancy and school dropout necessitate a particular environment. The effect of the aggregated group behaviour on the individual's behaviour is considered an 'endogenous effect' (Manski, 1995), e.g. the effect of teenage pregnancy rate in a neighbourhood on a teenager's propensity to be pregnant. A 'contextual' or 'compositional' effect in contrast is the influence of the group distribution in exogenous background characteristics such as ethnicity

(Manski, 1995). Although Manski (1995, p. 129) warns against the '*the juxtaposition of endogenous-effect theorising and contextual effect empirical analysis*', compositional effects can be important predictors (see the arguments of Thrupp et al., 2002). First, compositional effects are rarely direct effects and like other variables, they proxy for crucial but unobserved factors such as parental investment in child education. But conversely, their high correlation with these unobserved influences also creates an 'omitted variable bias' problem, i.e. the possibility that the observed effect is the unobservables simultaneously influencing both the composition variable and the outcome variable (see review of methodological issues in Blume et al., 2011). Therefore, ethnic composition needs to be treated like any endogenous variable using econometric solutions such as instrumental variables, panel data, and regression discontinuity (Blume et al., 2011). Alternatively, there is the regression discontinuity method via a 'contextual tipping point' (Lamberson and Page, 2012) where the peer effect is established based on the (endogenous) discontinuity in its effect on an outcome variable like school dropout.

Van Ewijk and Slegers (2010a, 2010b) conclude in their meta-analyses that both socioeconomic and ethnic peer effects matter in explaining educational achievement. The ethnic compositional effect differs depending on one's ethnic or migrant background. Although far from conclusive, most studies concur that the compositional effect of peers from disadvantaged or immigrant background have a larger effect on students of the same background, and a considerably smaller, if at all, effect on the advantaged or native background students (Angrist and Lang, 2004; Geay et al., 2013; Guryan, 2004; Hanushek et al., 2009; Hoxby, 2000; Ohinata and Ours, 2011; Peetsma et al., 2006; Schneeweis, 2013). In many studies, including this thesis, the 'ethnic peer effect' is in fact a proxy to unobserved wider influences, e.g. the use of the national language at home, parental aspiration, and social capital¹¹.

1.6. Research gap

With the growing availability of microdata, the potential for neoclassical economics and preference-based research in ethnic segregation is rich. Theoretical and empirical models have also been developed (e.g. Bajari and Kahn, 2005; Card et al., 2008a) for the United States context and so further applications in other countries could enrich the discussion of results derived from comparable methodologies. In particular, a comparison with Western Europe is informative due to the different native-migrant social dynamics and the larger role of the welfare state in mediating social inequality and the market effects of preference per

¹¹ 'Social capital' here is defined as '*features of social organization such as networks, norms, and social trust that facilitate coordination and cooperation for mutual benefit*' (Putnam, 1995, p. 66).

se. The Netherlands makes an instructive case study: a densely populated country with a strong tradition in urban planning, a heavily regulated housing sector, and constitutionally enshrined parental choice of schools.

Most micro-level studies on residential location choice do not simultaneously account for the fact that (i) both housing and school are heterogeneous goods with attributes that are not equally valued and must be traded-off with one another; and (ii) household preferences for these attributes are heterogeneous too. As a matter of fact, preferences are becoming key explanatory factors with the commodification of housing. In the Netherlands, this involved mortgage interest rate tax deduction for homeowners (c.f. Boelhouwer et al., 2004) and the expansion of the owner occupation sector at the expense of its relatively large social rented sector. Even non-western minority households are slowly eschewing social housing for homeownership in the Netherlands. It is still unclear what effects these developments would have on the state of ethnic segregation in the country.

In addition, a large part of segregation research deals with peer effects on children and adolescents. In spite of the related theoretical literature on social-cognitive development of children (Bronfenbrenner, 1989), few studies incorporate a long-term analysis on peer effects (e.g. Reynolds et al., 2001). More so on educational outcomes such as high school dropout that make up '*the culmination of a long-term process of academic disengagement*' (Alexander et al., 1997). Also, the estimation of peer effects is often reliant on secondary, non-experimental data that introduces a number of methodological problems. With indeterminate research conclusions on the existence – or if it exists, the extent and form – of school peer effects, establishing causality is a primary endeavour in today's segregation research.

Lastly, pro-integrationist policymakers are concerned about neighbourhoods experiencing 'white flight' or the departure of native or advantaged households which would lead to hyper-segregated neighbourhoods. Research on nonlinear dynamics of neighbourhood composition remains scarce, even for a country concerned with segregation and has a long tradition of urban planning such as the Netherlands. The literature on neighbourhood segregation is dominated by studies on residential location choices (e.g. van der Laan Bouma-Doff, 2007; van Ham and Feijten, 2008; Zorlu and Latten, 2009). While preferences play a key role in determining neighbourhood composition, it alone paints an incomplete picture. Extensions to the neoclassical economics approach take into account the social interactive effects of preferences and the external constraints that influence choices and segregation outcomes (c.f. Becker and Murphy, 2000).

1.7. The Netherlands as an ‘immigrant nation’

For a country of 16.7 million, an estimated 21 percent of Dutch population have a migrant background (CBS 2013a). They are referred to as ‘*allochtoon*’, i.e. someone who has at least one of her parents born abroad. A second-generation *allochtoon* is born in the Netherlands. The use of ‘country of origin’ as a defining characteristic in administrative data along with its academic derivatives is not without critique (see Phillips, 2007 for a critical review). In its four largest cities, this group constitutes more than a third of its residents – the majority being of ‘non-western’ origin. The ‘non-western’ group comprise of those with a Turkish, African, Latin-American, Caribbean, and Asian background although notably, with the exception of Japanese and Indonesian. The exception is due to their perceived higher socioeconomic position in Dutch society (c.f. Alders, 2001) – implying that the ‘non-western’ categorisation contains a socioeconomic dimension. By this definition and historical events (such as the ‘guest worker’ schemes from the 1960s and 1970s), non-western migrants have typically assumed a low socioeconomic status when they first entered the country. Subsequent social mobility and assimilation of the group have been hampered by the steady inflow of low-educated and non-Dutch-speaking family migrants via the family formation and reunification channels (Bonjour, 2008; Tweede Kamer, 2004a). To illustrate, as high as 72 percent of local-born, second-generation ethnic Turkish men and 69 percent of second-generation ethnic Turkish women had married a partner from their country of ancestry in 2000 (Hooghiemstra, 2003).

Next to demographic factors, scholars have also attributed the persistence of ethnic segregation in Dutch society to the historical institutionalised social segregation along religious and ideological cleavages, also known as ‘*verzuiling*’ or ‘pillarisation’ (Entzinger, 2006; Koopmans et al., 2005; see the seminal thesis of Lijphart, 1968). The ‘new minorities’ eventually gained access to religious and cultural rights afforded to historical minority groups under ‘pillarisation’, including equal public funding for community-specific amenities such as Islamic schools. This was not always the case as portrayed by the evolution of the main migration regulations and policies summarised in Table 1.2. Migrant-related policymaking before the 1980s was geared towards migrants and their offspring’s return to their countries, e.g. the teaching of migrants’ own mother tongue to their children to encourage reintegration.

Their non-temporary status was only recognised in the 1980s under the ‘ethnic minorities policy’ (*Minderhedennota*) when it became apparent that they were here to stay (Ministerie van Binnenlandse Zaken, 1983; Penninx, 2006). Naturalisation laws were simplified for long-term residents and for family migration at the apex of the 1980s liberal migration policies (Bonjour, 2008). Streamlining policies at the

national level, e.g. the 1985 'Education Priority Policy' (*Onderwijsvoorrangsbeleid*) that introduced additional public school funding for students of migrant background, relieved the burden of large city municipalities where most minorities resided. But soon after came the pro-assimilation political pressure. The 'multiculturalist' tone in policy was replaced by 'integrationist' policies in the 1990s to encourage the responsibility of the 'new minorities' towards their own cultural and socioeconomic assimilation (Penninx, 2006; Tweede Kamer, 1994).

Compared to the rest of Europe, the Netherlands was a pioneer in linking integration obligations of migrants to their rights (Kraler, 2010), e.g. with a mandatory civic integration course. Minorities-related policies soon extended well beyond immigration and integration spheres. For instance, the 'Big City Policies' (*Grotestedenbeleid*) of the 1990s targeted spatial concentrations of structural and social problems in large cities (Ministrie van VROM 1997). Ethnic-based desegregation was never an explicit policy focus yet the coalescence of the 'non-western' and low socioeconomic statuses has provided a convenient pretext (Kleinmans, 2004). Further anti-immigrant, pro-assimilation political pressure came by means of public discourse (e.g. Scheffer, 2000) and the electoral successes of the far-right populist party, *Lijst Pim Fortuyn* (LPF) between 2001 and 2002. Despite the short-lived success of LPF, its core agenda items such as opposition towards unregulated immigration and a stronger assimilation policy stance have been co-opted by the mainstream political parties. Education policies were politicised with the abolishment of additional school funding for students of migrant background (Ladd and Fiske, 2009a).

Stricter immigration regulations effectively reduced the numbers of asylum-seekers and low-skilled migrants, so much so that the Netherlands became a country of net emigration by 2003 (Latten and Nicolaas, 2006). The emigration pattern ended in 2008 after the abolishment of work permit requirements for citizens of the 2004 new EU member states except Romania and Bulgaria (Sanderse et al., 2011).

Table 1.2: Overview of key Dutch and related EU migration law and policies

1968	Regulation No 1612/68 on free movement of workers within the European Community <i>Regulation codified 1961 Regulation No. 15 that stipulated the right of the spouse and children aged under 21, regardless of their nationality, to join the worker</i>
1974	Mother Tongue and Culture Programme <i>Programme targeted at children of guest-workers for their reintegration into the sending countries</i>
1983	Ethnic Minorities Policy Outline <i>Policy aimed to ensure minorities' social inclusion and equity in all domains</i>
1984	Nationality Act of 1984 <i>Law simplified the naturalisation conditions for long-term foreign residents and their children</i>
1985	Education Priority Policy <i>Public funding policy of schools allocates additional weight for schools with more migrant pupils</i>
1994	Ethnic Minorities Integration Policy Outline <i>Policy emphasised the obligation-based citizenship for minorities to integrate</i>
1994	Big City Policy <i>Policy targeted structurally and socially deprived areas in the four largest cities.</i>
1998	Linkage Act of 1998 <i>Law ties state benefits and access to education, healthcare, and housing to legal residency</i>
1998	Civic Integration for Newcomers Act <i>Law imposed mandatory civic integration courses for newcomers</i>
2000	New Aliens Law of 2000 <i>Law speed up the asylum request adjudication and curtailed possibilities for appeal</i>
2003	Dutch Citizenship Act <i>Law imposed mandatory Dutch language and cultural test for naturalization</i>
2003	Council Directive 2003/86/EC on the right to family reunification <i>Regulation extended the right of family reunification to non-temporary third-country nationals</i>
2003	Council Directive 2003/109/EC on third-country nationals who are long-term residents <i>Regulation stipulated the equal rights of third-country nationals who are long-term residents in employment, social protection, housing, and education</i>
2004	Council Directive 2004/38/EC on the free movement of citizens and family members <i>Regulation granted permanent residence right to family members after five years of legal residency</i>
2004	Amendment to the Alien Decree of 2000 <i>Law raised the income requirement for family formation to 120% of the minimum wage and the minimum age for both partners to 21</i>
2004	Knowledge worker scheme <i>Scheme abolished the work permit requirement for all researchers and workers with income above a certain threshold</i>
2006	Civic Integration Act <i>Law imposed mandatory Dutch language and cultural test abroad for potential family migrants</i>
2007	Regularisation programme of (former) asylum seekers <i>Programme naturalised asylum seekers who had filed their requests before 2001</i>
2007	Restrictions lifted for workers from 8 new EU-states <i>Work permit requirement for 2004 new EU members abolished except for Romania and Bulgaria</i>
2010	European Court of Justice ruling on the Dutch 120% income requirement for family formation <i>Court ruled the 120% regulation to be in conflict with European Directive on family reunification which led to its abolishment</i>
2014	Restrictions lifted for workers from Romania and Bulgaria <i>Work permit requirement abolished for Romania and Bulgaria</i>

Note: Adapted from Groenendijk (2006), Bruquetas-Callejo et al. (2011), and OECD (2008b). Regulations and policies refer to national Dutch regulations and policies unless specified otherwise.

The effects of EU regulations on national migration policies in the recent decade have been far-reaching, e.g. with the formal extension of the 1961 European Community Law on the right of family reunification to third-country nationals via Council Directives 2003/86/EC and 2004/38/EC. National misgivings aside, 'immigrant nation' appears to be the inevitable consequence of a common market.

1.8. Contributions of the thesis

Based on the identified research gap, this thesis makes several empirical and methodological contributions. There is, in particular, a niche for quantitative analysis of ethnic segregation using cross-nationally comparable methodologies. Chapters 2 and 5 represent unique empirical applications of existing theoretical and empirical models (Bajari and Kahn, 2005; Card et al., 2008a) to the relevant Dutch context and data, some of which involved restricted-access, high quality administrative data. The thesis also adds three novel methodological contributions to the current study of ethnic segregation: (i) nonparametric estimation of housing choice within a price hedonic framework; (ii) nested logit estimation of primary school choice; and (iii) statistical testing of school peer effect via regression discontinuity method at an endogenously identified 'contextual tipping point'. These contributions are outlined by chapter below.

Chapter two

Chapter 2 contributes to this literature by taking into account the bundling nature of housing and neighbourhood attributes within a housing market, i.e. a household does not choose neighbourhood composition per se but rather trades it off with many other characteristics of different importance to the household. Based on price hedonic theory, Chapter 2 tests a fully nonparametric two-step model of housing choice using the 2009 'Dutch Housing and Living Survey' that is linked to rich neighbourhood-level administrative data. The main rationale for the two-step framework is that it not only provides the 'implicit price' of each attribute, it also estimates household marginal willingness to pay for non-western minority neighbours. The latter is basically a test of the assimilation theory in the Netherlands, i.e. if homeowners of non-western migrant background have a negative willingness to pay for living next to more co-ethnic neighbours.

Methodologically, Chapter 2 applies a fully nonparametric model of housing choice using generalised product kernels which allows for the smoothing of both categorical and continuous variables (Li and Racine, 2004; Racine and Li, 2004). A priori theory on how the different housing and neighbourhood attributes should relate to one another in relation to dwelling price is non-existent. Yet most studies use some form of parametric method that makes strong assumptions about the relationships or functional forms which, if untrue, would bias the estimation of

each attribute's implicit price. Using a fully nonparametric method is more appropriate because it relaxes the parametric assumptions to accommodate the unknown functional forms as revealed by data.

Chapter three

Chapter 3 evaluates the school choices of students following an exogenously determined policy intervention – forced school closure – using restricted-access school enrolment records that are linked to public school funding and personnel data from the Ministry of Education, Culture, and Science. The resulting school choices of the students forced to move were unforeseen and considered undesirable by policymakers. The chapter contributes to policymaking by testing the idea that school types or religious denominations are not equal in the eyes of (some) parents. By isolating the determinants of school choice, similar policy interventions in the future can account for the availability of desirable school substitutes to students and parents during the policymaking process.

Chapter 3 evaluates the determinants of compulsory primary school choice within school type using discrete school choice models (McFadden, 1978). With restricted-access population data of primary school enrolment for the whole of Amsterdam – i.e. all school choices within the municipality can be observed during the observation period – a conditional logit discrete school choice model can be estimated. Conditional logit models let the school-specific attributes to dictate choice, in particular pair-wise combined information between individual-specific attribute and school-specific attribute, such as residence-to-school distance. Since the student sample is fairly homogeneous, a mixed logit framework allowing for heterogeneous preferences is not necessary in this case. However, school choice is expected to be nested in school type since many in the study sample have stated their preference for staying within the same denominational schools after the forced school closure. This study using a nested estimation avoids biased estimates of the choice determinants by allowing for the correlation of school-specific error terms within the same school type.

Chapter four

Since a binding outcome such as school dropout is expected to be caused by long-term cumulative factors (Alexander et al., 1997), the ideal data would involve observing the sample from a fairly young age. Chapter 4 does so with a unique, restricted-access administrative data linking primary school factors – such as peer ethnicity and school mobility – to a high school outcome. The added bonus of doing so is that we avoid the disadvantage of using more contemporaneous measures that may be endogenous to the dependent variable. For example, potentially problematic behaviour such as frequent school mobility could be a cause for one to drop out of school or it could simply be subject to the same

unobserved factors underlying one's propensity for early school leaving (Bowditch, 1993).

Chapter 4 tests the effect of school segregation on school dropout by exploiting the discontinuity in school peer effect on predicted probability of school dropout using regression discontinuity method. Without an exogenous source of discontinuity, e.g. via policy intervention, an endogenous source of discontinuity can be exploited to derive unbiased estimates of peer effect. This point of discontinuity is known as a 'contextual tipping point' since it involves the discontinuous effect of a gradual change in one variable on another variable of interest (Lamberson and Page, 2012). As long as parents and students do not precisely self-select into schools at either side of the 'contextual tipping point', the omitted variable bias problem can be alleviated to establish causality between the share of non-western peers in primary school and high school dropout.

Chapter five

Using three metropolitan area samples in the Netherlands, Chapter 5 tests the potential 'tipping points' (c.f. Schelling, 1972, 1971) in neighbourhood ethnic composition, beyond which 'white flight' occurs. The main contribution of 'tipping point' research is that it offers a dynamic perspective to neighbourhood ethnic composition and the possibility of distinguishing 'remedial' and 'preventive' target neighbourhoods for area-based policymaking. Too often area-based policies target neighbourhoods that are already in decline. A dynamic neighbourhood monitoring mechanism could also be incorporated in the design of sustainable future housing and neighbourhood policies.

1.9. Thesis outline

The three main themes of ethnic segregation identified in the literature section – preferences for peer composition, nonlinear dynamics in peer composition, and peer effects of segregation – are dealt with over four empirical chapters in this thesis. Figure 1.4 outlines the themes and sub-themes alongside the corresponding chapters.

After the 'Introduction' chapter, the following Chapter 2 examines preferences for housing and neighbourhood attributes among homeowners in the Netherlands. Do native Dutch and non-western minority homeowners have different preferences for neighbourhood ethnic composition? Borrowing from price hedonic theory, the study estimates ethnic differences in marginal willingness to pay for non-western minority neighbours.

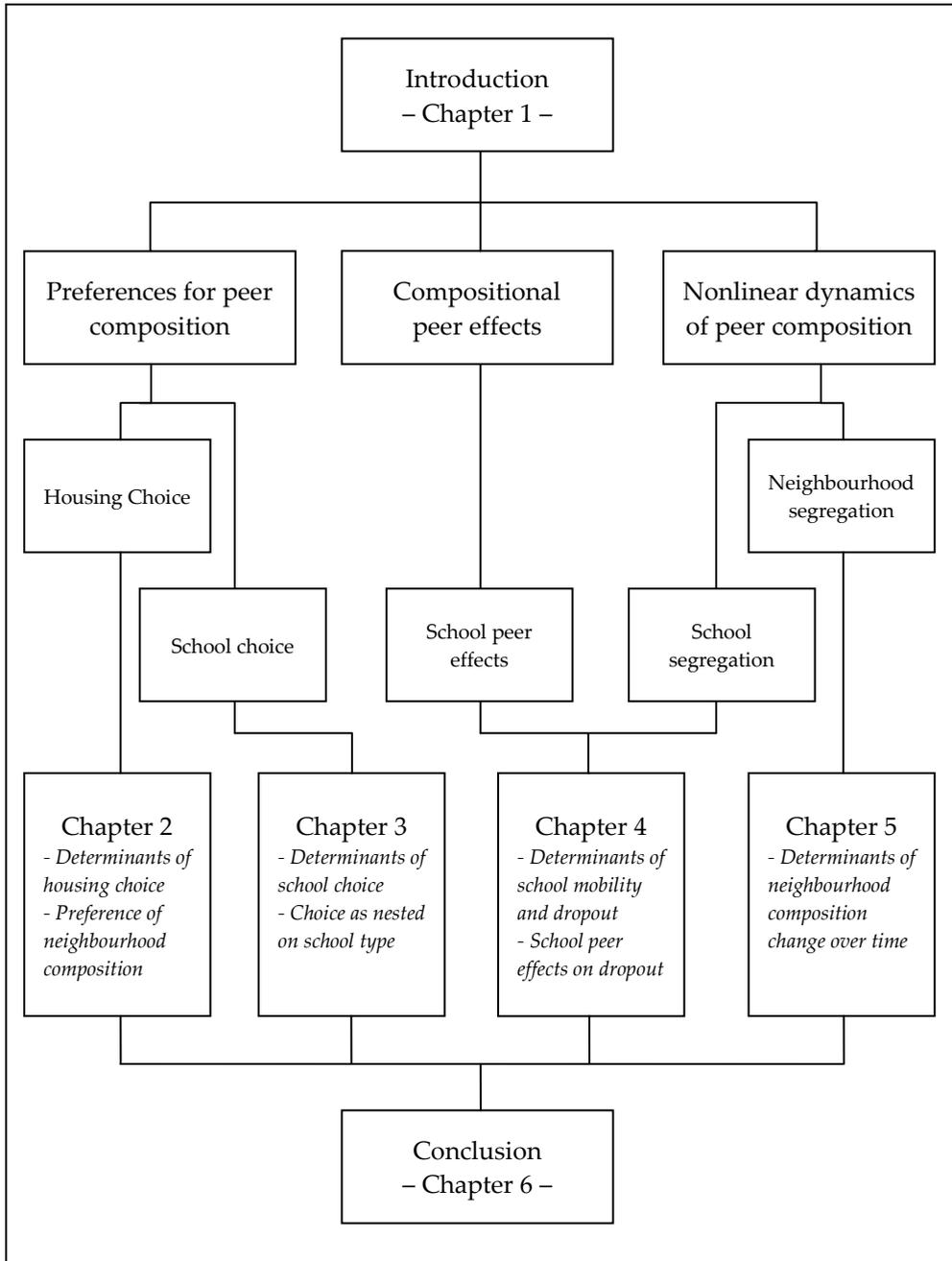
Chapter 3 exploits the forced closure of three segregated primary schools in Amsterdam to establish the determinants of school choice of ethnic minority pupils. Do students re-concentrate into the same school(s) or do they disperse into different schools? Do they prefer schools with more peers of their own (non-western and low socioeconomic) background? Our analysis contrasts the respective school choice decisions of the 'early movers' who had voluntarily changed schools within two years before the forced closure and the 'forced movers' who had to move to other schools after the closure.

Chapter 4 investigates the influences of ethnic composition and school mobility at the primary school-level on the propensity to drop out of high school in Amsterdam. Controlling for school mobility and other factors, the effect of ethnic school segregation on early school leaving is tested. Is there an effect of ethnic school composition on the likelihood of school dropout? To establish causality, a discontinuity in the predicted probability of school dropout with respect to the share of non-western school peers is determined and tested.

Chapter 5 analyses the evolution of neighbourhood ethnic composition as a social interaction outcome of disaggregated household behaviour. 'White flight' or the departure of native or socially advantaged households from neighbourhoods is hypothesised to occur when minority share rises above some threshold. Did some segregated neighbourhoods in Dutch large cities 'tip' towards an all non-western minority composition? The chapter searches for potential discontinuities in the relative change in neighbourhood native Dutch and western minority population in relation to neighbourhood non-western minority share. These candidate 'tipping points' of major Dutch conurbations are then statistically tested.

Lastly, Chapter 6 concludes with a summary of the research findings within the study limitations and a menu of policy and future research recommendations.

Figure 1.4: Thesis outline



2. Housing choice of homeowners¹²

2.1. Introduction

Neighbours' tastes, habits, and incomes are externalities that influence housing value (Bailey, 1959). Unlike other goods, housing is a heterogeneous good made up of utility-deriving quality attributes that include neighbourhood externalities such as public safety, crowding, pollution, composition of neighbours, and proximity to various amenities. This chapter tests for ethnically differentiated preferences for neighbourhood ethnic composition, i.e. if native Dutch and non-western minority homeowners have different preferences for their own neighbourhood's ethnic composition. We follow the framework developed by Bajari and Kahn (2005) which relies on price hedonic modelling commonly used in real estate valuation. Housing is treated as a 'heterogeneous good' or a bundle of quality attributes such that the housing price can be decomposed into attribute-specific 'implicit prices'. Given their budget constraint, utility-maximising households are assumed to trade off various desired housing and neighbourhood attributes. The price hedonic model parameterises housing demand and allows, in a second stage, for the estimation of households' marginal willingness to pay (MWTP) for various quality attributes including neighbourhood qualities and composition.

As outlined in Chapter 1, this chapter contributes to the literature by its fully nonparametric estimation procedure. Nonparametric methods relax the parametric assumptions to accommodate the unknown functional forms that relate different housing or neighbourhood characteristics to dwelling price. Departing from Bajari and Kahn (2005), we use local linear estimation with generalised product kernels in the first-stage price hedonic estimation. We adapt the approach by mixed kernel estimations, as suggested by Racine and Li (2004; 2004), which allows for the smoothing of both categorical and continuous variables. This alleviates the problem of sparse cells due to insufficient observations.

As a second contribution, we test the microeconomic consumer choice theory model using rich Dutch housing choice data. The Netherlands makes an interesting case study for our purpose. In contrast with the segregation discourse in North American cities (Charles, 2003; Ellen, 2000; Massey and Denton, 1993; Wilson, 1987), 'ethnic segregation' in West European countries like the Netherlands

¹² This chapter is based on the paper: Ong, Cheng Boon, and Kristof De Witte. (2013a). "Ethnic Segregation and Heterogeneous Preferences of Homeowners for Housing and Neighbourhood Characteristics. Evidence from the Netherlands." *UNU-MERIT Working Paper Series* (2013-061).

revolves around a relatively homogenous ethnic majority that make up the 'nation state' and the heterogeneous immigrant minority that have arrived in the recent decades.

As a final contribution, the chapter examines whether immigrants assimilate into the host society. Specifically, we investigate if households with a migrant background seek to purchase their homes in the same neighbourhoods as the native population households (Alba and Logan, 1992; Borjas, 2002; Logan et al., 2002). Although non-western households tend to be social housing tenants – 66 percent in 2006 compared to 31 percent for native Dutch households – they are increasingly becoming homeowners, up to 23 percent as of 2006, compared to 60 percent for native Dutch households and 43 percent for western minority households (Ministrie VROM 2006, authors' own calculation). In a country where policymakers have actively encouraged homeownership, understanding homeowner preferences is crucial to the neighbourhood segregation debate.

The chapter unfolds as follows. Section 2.2 provides a literature review while section 2.3 outlines a behaviour model to causally explain residential segregation. Section 2.4 discusses the estimation theory which is then followed by the data descriptive and results in Sections 2.5 and 2.6. A final section concludes the chapter.

2.2. Literature review

We summarise the literature along three lines. The first two subsections focus on the quality attributes of housing and the influence of ethnicity on preferences. In the behavioural model outlined in Section 2.3, this corresponds to the first- (quality attributes) and second- stages (ethnic preferences). A third subsection provides an overview on the nonparametric estimation procedure.

2.2.1. Housing as a heterogeneous good

In basic consumer choice theory, the consumption good is assumed to be homogeneous. Building upon this, Houthakker (1952) introduced the notion of variety in a consumption good differentiated by its 'quality' characteristics while Lancaster (1966) redefined the idea of deriving utility from a good per se into '*supposing that it is the properties or characteristics of the goods from which utility is derived*'. The hedonic¹³ price model accommodates the 'heterogeneous good', a

¹³ 'Hedonic' here appeals to the utilitarianism, as such 'hedonic price comparisons are those which recognise the potential contribution of any commodity to the welfare and happiness of its purchasers' (Court, 1939, p. 107).

good as a bundle of quality attributes with a price that can be decomposed into these attribute-specific implicit prices.

Appealing to 'revealed preference' theory whereby *observable* choices are said to "reveal" a consumer's *unobservable* preference set for goods given each budget constraint, Rosen's (1974) seminal paper introduced a two-stage estimation procedure in which the first price hedonic stage estimates the 'implicit marginal price' of each attribute by decomposing price onto the product's observed characteristics. The second stage then recovers the structural demand parameters for each attribute with the estimated marginal price and consumer characteristics¹⁴. Departing from Lancaster (1966), Rosen (1974) assumes that attributes cannot be unpackaged and sold separately – the indivisibility assumption – which is realistic for a durable consumption good like housing. Consequent of Rosen's (1974) theoretical work of deriving demand systems using a hedonic model, the hedonic price literature has expanded quickly to include housing markets and environmental valuation (for a recent summary of related literature see Baranzini et al., 2008).

Typically, first-stage price hedonic models involve many relevant housing and neighbourhood characteristics that influence the price such as dwelling size, number of rooms, availability of garden and garage, and so forth (see the review by Malpezzi, 2002 and references therein). Some attributes are culture, history or period-specific, which for aesthetics or (construction and maintenance) quality reasons can influence housing price (Kain and Quigley, 1970; Rubin, 1993). Unlike other goods, the spatial dimension to housing means that location matters whether it is to the central business district and other areas for access to employment, goods and services (see references in Cheshire and Sheppard, 1995; Glaeser et al., 2008). The housing good is also very much susceptible to the effects of 'local' markets (Goodman, 1978), usually defined by municipality or metropolitan statistical area. The same dwelling in terms of structural and neighbourhood characteristics could be worth differently across local housing markets due to the role of local municipality and other actors (e.g. housing associations), market size and structure (e.g. rental-homeowner stock), demography, local economy, and geographical location (De Bruyne and Van Hove, 2006).

¹⁴ Rosen's second stage is often criticised for identification problems (c.f. Bartik, 1987) but this problem can be circumvented by, among others, locally estimating preferences in the second-stage as done in this chapter based on the framework of Bajari and Kahn (2005).

2.2.2. Heterogeneous preferences and ethnic segregation

Spatial segregation between native and immigrant households has long been considered an indicator of migrant assimilation¹⁵ into the host society (Alba et al., 1999; Alba and Logan, 1992; Logan et al., 2002; Massey, 1981; Park et al., 1925). Ethnic minority households could favour living in neighbourhoods of co-ethnic concentration out of preference and taste, such as the availability of cultural-specific goods and services (Aldrich and Waldinger, 1990; Logan et al., 2002). Perception of security from having neighbours similar to one plays a role too (Farley et al., 1978). The spatial assimilation model views enclaves as transitory and predicts that, as disadvantaged minority members acculturate, they leave behind the enclaves to join neighbourhoods resided by the desirable or dominant group (Logan et al., 2002; Wilson, 1987). There is also a 'generational dynamic' with subsequent generation(s) of the minority group moving towards assimilation – for instance in their suburbanisation following the dominant group's residential mobility behaviour (Alba et al., 1999; Gans, 1992; Zorlu, 2009). As pointed out by Alba and Logan (1992 p. 1315), *'homeownership, like educational and occupational advancement, residential integration or acculturation, is a potential step towards assimilation of minority group members into mainstream society'*. Since homeowners are considered as more committed than renters to their neighbourhoods (Rohe and Stewart, 1996), homeownership by households of migrant background can additionally be interpreted as their long-term commitment to the host society (Constant et al., 2009).

Earlier sociological studies are often ecological, focused at the community or neighbourhood-level (c.f. Duncan and Lieberson, 1959; Massey and Denton, 1993; Park et al., 1925). This contrasts to microeconomic behavioural models based on consumer choice theory that attempt to causally explain residential segregation at the individual household-level (among others see Bajari and Kahn, 2008, 2005; Bayer et al., 2007; for a review, refer to Durlauf, 2004). Schelling's theoretical framework of linking neighbourhood attributes to the individual's utility function provides the basis for the latter line of residential segregation research (1972, 1971). Bajari and Kahn (2008, 2005) extend Rosen's price hedonic framework with a multi-step estimation procedure. Those in favour of the alternative method – random utility or discrete choice models (c.f. McFadden, 1978) – contend that hedonic price models assume that households can choose the level of consumption for every attribute (i.e. dense product space) when they are actually constrained by the limited housing bundles offered in the market (discussed in Bajari and Benkard, 2005; for applied examples of the discrete choice model, see Barrios García and Rodríguez Hernández, 2008; Bayer and McMillan, 2008; Wong, 2013). Nonetheless,

¹⁵ 'Assimilation' here is used interchangeably with 'acculturation'.

the fact that Schelling's difference in individual preferences for neighbourhood composition can be statistically tested using housing choice data makes these models extremely appealing (Durlauf, 2004).

2.2.3. Nonparametric method using generalised mixed kernels

Nonparametric methods are often favoured over the more rigid parametric and semi-parametric methods due to the lack of an a priori theory as to how variables should relate to one another (Anglin and Gencay, 1996; Halvorsen and Pollakowski, 1981; Malpezzi, 2002; Parmeter et al., 2007; Triplett, 2006; Yatchew, 1998). Triplett (2006) adds that a nonparametric data-driven estimation of the hedonic function is the most appropriate method for finding each product characteristic's implicit price since *'imposing some rule for what the hedonic function "should" look like destroys part of the information that market prices convey'*. Along these lines, Bajari and Kahn (2008, 2005) utilise a flexible local linear specification of the price hedonic first stage to recover the random coefficients of housing preferences which are then modelled as a function of household demographics and household-specific shocks. In contrast, parametric specifications for the random coefficients usually assume independence and normal distribution. For a bundled good such as housing, relaxing the independence assumption with nonparametric estimation is clearly advantageous, e.g. a high valuation of dwelling size can be associated with a high valuation on the number of rooms (Bajari and Kahn, 2008).

But by not smoothing these regressors, Bajari and Kahn (2008, 2005) effectively used the 'frequency estimator' approach which splits the sample into cells based on discrete data before nonparametrically estimating the joint distributions of the continuous variables (see Racine and Li, 2004 for a more elaborate discussion). This introduces the 'curse of dimensionality' problem (Hastie and Tibshirani, 1990; Silverman, 1986), i.e. the problem of making meaningful local estimations with scarce data points in multidimensional grids as the number of dimensions (only in continuous covariates, see Racine, 2008) increases. This problem was evident in Bajari and Kahn's analysis that was restricted to seven regressors and the authors admitted that their method was subsequently not fully nonparametric (Bajari and Kahn, 2005). Semi-parametric methods could alleviate the 'curse of dimensionality' (see Hastie and Tibshirani, 1990; Lall and Lundberg, 2007). So do full nonparametric alternatives such as Racine and Li's (2004; 2004) mixed kernel estimation which allows for the smoothing of both categorical and continuous variables.

2.3. A theoretical model of housing choice

In the case of a heterogeneous good with heterogeneous buyers, households paying the same housing price can face different implicit prices for the various housing and neighbourhood characteristics. From the available housing choice data – i.e. the chosen bundle of housing attributes, the house price, and household characteristics – we need to infer the *unobserved* implicit prices and *unobserved* household preferences for each quality attribute. Hence, several key assumptions are required to extend consumer choice theory into estimating heterogeneous household demand or ‘willingness to pay’ for a specific attribute such as ethnic composition of neighbours. The next section follows the theoretical framework developed by Bajari and Benkard (2005) as applied in the housing choice context by Bajari and Kahn (2008, 2005).

Consider a model of i ($1, \dots, I$) households, each consuming one of the j ($1, \dots, J$) housing units with their respective k ($1, \dots, K$) attributes and deriving heterogeneous dwelling-specific utility, u_{ij} . A dwelling unit consists of its observed structural and surrounding neighbourhood characteristics, $x_{j,k}$ and unobserved attributes, ξ_j . Utility is also assumed to be time-separable in order to model housing choice as a static utility maximisation problem with c as the numéraire good, and y_i as individual household income:

$$u_{ij} = \max_j u_i(x_j, \xi_j, c) \text{ subject to: } p_j + c = y_i \quad (2.1)$$

$$p_j = \mathbf{p}(x_j, \xi_j) \quad (2.2)$$

such that price, p_j , is a function of the observed and unobserved attributes, $\mathbf{p}(x, \xi)$. In equilibrium, substituting the budget constraint into the utility function allows us to find the utility maximising housing bundle, j^* for household i :

$$j^*(i) = \arg \max_j u_i(x_j, \xi_j, y_i - \mathbf{p}(x_j, \xi_j)) \quad (2.3)$$

With no adjustment costs and in a perfectly competitive market, this first-order condition of the utility function for continuous characteristics must hold:

$$\frac{\delta u_i(\mathbf{x}_j^*, \xi_j^*, y_i - p_j^*)}{\delta x_{j,k}} - \frac{\delta u_i(\mathbf{x}_j^*, \xi_j^*, y_i - p_j^*)}{\delta c} \frac{\delta \mathbf{p}(\mathbf{x}_j^*, \xi_j^*)}{\delta x_{j,k}} = 0 \quad (2.4)$$

$$\frac{\delta u_i(\mathbf{x}_j^*, \xi_j^*, y_i - p_j^*) / \delta x_{j,k}}{\delta u_i(\mathbf{x}_j^*, \xi_j^*, y_i - p_j^*) / \delta c} = \frac{\delta \mathbf{p}(\mathbf{x}_j^*, \xi_j^*)}{\delta x_{j,k}} \quad (2.5)$$

We find that under optimality, the marginal rate of substitution between $x_{j,k}$ and c on the left-hand side is equal to the partial derivative of the hedonic function (the marginal price of $x_{j,k}$ in the market) on the right-hand side.

For identification reasons in a cross-section data setting where households are only observed once, we assume an additive, quasi-linear functional form for the utility function with the price of the numéraire good, c set to unity (Bajari and Benkard, 2005):

$$u_{i,j} = u(x_j, \xi_j, c) = \beta_{i,x} \ln x_j + \beta_{i,\xi} \ln \xi_j + c \quad (2.6)$$

The assumptions above let us to recover the household-specific taste parameter, $\beta_{i,k}$, for continuous housing attribute k when the household observes its utility-maximising dwelling unit, j^* .

$$\hat{\beta}_{i,k} = x_{j^*,k} \left(\frac{\partial p(x_{j^*}, \xi_{j^*})}{\partial x_{j,k}} \right) \quad (2.7)$$

Under this specification, the household-specific taste parameter, $\beta_{i,k}$ for housing attribute k depends not only on its implicit price, but also on the consumption level of k , $x_{j^*,k}$ as part of dwelling unit j^* . Based on a threshold decision-making rule, households will only choose a dichotomous attribute when their taste parameter for it, $\beta_{i,k}$, is above its implicit price, i.e. the difference in dwelling price due solely to this attribute, $\Delta p / \Delta k$ while other attributes are held at corresponding values in x_{j^*} (Bajari and Kahn, 2005).

Heterogeneous preferences are then modelled with $\beta_{i,k}$'s interpreted as random coefficients that are a function of household characteristics d_i and orthogonal household-specific residual, η_i :

$$\beta_{i,k} = f_k(d_i) + \eta_{i,k} \quad (2.8)$$

$$E(\eta_i | d_i) = 0 \quad (2.9)$$

We note that the above restrictive assumption of the utility function limits substitution effects across housing attributes and assumes zero income elasticity of demand for each attribute. This was necessary to identify heterogeneous preferences using only cross-sectional data as ours, we refer to the discussion in Bajari and Benkard (2005) and an earlier critique of Rosen by Bartik (1987). Additionally, while there are other functional forms of hedonic price regression, such as the semi-log and Box-Cox specifications, the theoretical consensus for selecting the correct form is non-existent (Malpezzi, 2002). Hence, we keep the

current functional form for identification and for comparison with Bajari and Kahn's (2005) empirical application in the United States. The above theoretical model will be tested according to the empirical strategy outlined in the next section.

2.4. Estimation Strategy

To test the theoretical model, we use insights from Bajari and Kahn's (2005) estimation procedure. This proceeds in two steps. (i) First, we estimate the hedonic price model by a fully nonparametric method with generalised smoothing kernels. This allows us to recover the household-specific taste parameters. (ii) In a second stage, using the household demographic characteristics, we estimate the marginal willingness to pay for an increase in non-western neighbours. We discuss the empirical strategy for both stages in more detail next.

2.4.1. First-stage: Reveal the attribute specific implicit prices

Consider a standard nonparametric model with an unknown functional form $f_j(\cdot)$ relating the housing price, p_{j^*} to distinct housing and neighbourhood attributes, χ_k :

$$p_{j^*} = f_j(\chi_k) + \xi_{j^*} \quad (2.10)$$

The housing bundle-specific residual, ξ_{j^*} is assumed to be independent from the observed attributes, χ_k . We estimate the model using local-linear least squares estimator as introduced by Fan and Gijbels (1996).

The local density estimation requires the specification of a bandwidth, which essentially controls the bias-variance trade-off. A small bandwidth would entail a more localised estimation (the extreme being intrapoolation) which reduces the bias but increases variance, while a bandwidth that is too large would oversmooth, reducing the estimator's variance while increasing its bias. While Bajari and Kahn (2005) have opted for bandwidth selection via visual inspection, we exploit the automated, data-driven fixed¹⁶ bandwidth selection method via cross-validation proposed by Hall et al. (2004) with corrected Akaike Information Criterion (Hurvich et al., 2002).¹⁷ Cross-validation is computationally intensive as it involves repeated estimation of kernel density, $\hat{f}_{n,-i}(\cdot)$ for each given i^{th} observation, X_i and

¹⁶ Due to potential 'spurious noise' associated with adaptive kernel estimators such as nearest-neighbour kernel estimator (Racine, 2008, p. 15) and the problem of obtaining valid bootstrapped standard errors for hypothesis testing, we employ the fixed bandwidth approach in this chapter.

¹⁷ Although Hall et al. (2004) used least-squares cross-validation (LSCV) procedure, the AIC method is asymptotically equivalent and performs well in small samples (Li and Racine, 2004). Henderson et al. (2006) also find it to be less susceptible to the problem of under-smoothing afflicting LSCV.

bandwidth, h using all observations except the i^{th} observation. The appropriate bandwidth is chosen by minimising the integrated mean squared errors from predicting $f(\chi_i)$ and helps to reduce the influence of irrelevant covariates by approximating towards the bandwidth's upper bound (Hall et al., 2007; Li and Racine, 2008).

The cross-validation bandwidth selection can be sensitive to outliers and 'discretised' continuous data (Hayfield and Racine, 2008; Racine, 2008). In the application, this could be problematic for some postcode neighbourhood data provided by Statistics Netherlands that is rounded to the nearest five percent. Hence, we omit extreme outliers¹⁸ and treat the relatively 'discrete' continuous variables such as number of rooms or percentage of welfare benefit recipient in neighbourhood as ordered discrete variables. This reduces the number of continuous variables which would also mitigate the 'curse of dimensionality' problem discussed earlier.

2.4.2. Second-stage: Estimating marginal willingness to pay

In a second stage, we model the aggregated household preference distribution. This allows us to measure household-specific demand or the marginal willingness to pay (MWTP) for quality attributes. This proceeds in two steps. First, we recover household-specific preference parameters, $\hat{\beta}_{i^*,k}$. They are a function of the observed amount of attribute k consumed within the optimal dwelling unit j^* , $x_{j^*,k}$ and its estimated implicit price (2008, 2005). The hedonic price model coefficients, $\hat{\beta}_{j^*,k}$ can be interpreted as implicit prices faced by households consuming bundle j^* . Hence, for each household, the attribute-specific taste parameters are calculated as:

$$\hat{\beta}_{i^*,k} = x_{j^*,k} \left(\frac{\partial p(x_{j^*}, \xi_{j^*})}{\partial x_{j^*,k}} \right) = x_{j^*,k} * \hat{\beta}_{j^*,k} \quad (2.11)$$

In a second step, the MWTP is derived from the joint distribution between the taste parameters derived in the second stage, $\hat{\beta}_{i^*,k}$ and household demographics, d_i . We use the same nonparametric methods as shown in the first-stage¹⁹ with an unknown functional form $f_k(\cdot)$ and assuming the orthogonality of the household-specific residual, $\eta_{i,k}$.

¹⁸ Using graphical methods to detect extreme outliers, we omit observations that have household income more than 10 standard deviations above the mean, or dwelling indoor size equal or more than 250m² or outdoor size equal or more than 300m². All omitted observations lie beyond the upper outer fences of the respective variable boxplots.

¹⁹ In contrast, Bajari and Kahn (2005) use ordinary least squares regression for ease of exposition.

$$MWTP_i^{10\%nonwest} = f_k(d_i) + \eta_{i,k} \quad (2.12)$$

The MWTP – in the application, for a 10 percent increase in neighbourhood proportion of non-western households – is calculated for each household using its respective taste parameter, $\hat{\beta}_{i^*,nonwest}^{20}$:

$$\begin{aligned} MWTP_i^{10\%nonwest} &= \hat{\beta}_{i^*,nonwest}(\log(1.1 * \chi_{j^*,nonwest}) - \log(\chi_{j^*,nonwest})) \quad (2.13) \\ &= \hat{\beta}_{i^*,nonwest}(\log(1.1)) \end{aligned}$$

2.4.3. Hypothesis testing using bootstrapping methods

To nonparametrically test statistical significance of the predictors, we use naïve bootstrapped standard errors with the assumption of independent and identically distributed draws. Bootstrap methods are found to be superior to asymptotic methods because they have good finite-sample properties and are robust to the effect of data-driven bandwidth selection (Racine, 1997; Racine et al., 2006). In contrast to parametric linear regression where the partial derivative of the conditional mean with respect to a continuous predictor is assumed to be constant over the entire domain, nonparametric regression allows for the predictor’s vector of partial derivatives to vary over its domain. Hence, the corresponding null hypothesis tests if these partial derivatives are equal to zero for the entire domain (Racine, 1997). Similarly, the null hypothesis for categorical regressors would be that the conditional mean with respect to the categorical variable z and a vector of other regressors \mathbf{x} are equal to the conditional mean with respect to only \mathbf{x} for ‘almost everywhere’ (Racine et al., 2006). Analogous to the standard t -tests in parametric regression, we refer to Racine (1997) and Racine et al. (2006) for the technical details with regards to hypothesis testing of continuous and categorical variables respectively.

2.5. Data

We use the 2009 national Dutch Housing Survey (*Woononderzoek Nederland, WoON*)²¹ dataset with information on household characteristics along with housing attributes, preferences and mobility for over 70,000 respondents (CBS

²⁰ Since we are examining household preference for a *constant* change in proportion of non-western residents (in line with our log specification of the covariate), we interpret $\hat{\beta}_{i^*,nonwest}(\log 1.1)$ as the marginal willingness to pay for a 10 percentage increase in non-western residents.

²¹ This “2009_r_1.4” version (Ministerie van Volkshuisvesting Ruimtelijke Ordening en Milieubeheer (VROM), 2009) was provided via the Data Archiving and Networked Services of the Royal Netherlands Academy of Arts and Sciences.

2010a). While we have conducted our analyses for the four largest cities in the Netherlands – Amsterdam, Rotterdam, The Hague, and Utrecht – within the confines of this chapter, we limit our discussion of the results to the municipality of The Hague which was oversampled that year with a total of 5,382 respondents, only 1,963 of which are homeowners. This much larger sample, by a factor of three compared to the other cities, produce robust estimates using the data-driven nonparametric method. Since we assume that households take neighbourhood characteristics as given while positive transaction costs of moving could hinder dissatisfied households from consuming their utility-maximising housing bundles in the short run, we limit our sample to homeowners who have lived in their dwellings for less than 10 years²². Excluding missing values, outliers, and those who have lived in their present dwellings for 10 years and beyond, the final analyses involve 1,145 homeowners in The Hague.

The dependent variable for the price hedonic estimation is the *self-reported* housing price. Malpezzi (2002) posits that '*while the variances of owner assessments are high, biases are modest*', hence owner-assessed housing price can be reliable given sufficient data. The alternative would be to use the imputed dwelling price, WOZ-value (*waardering onroerende zaken waarde*) used by the local municipality to assess property tax per dwelling but we risk systematic bias from data imputation.

With the four-digit postcode identifier, household-level information is then complemented with neighbourhood-level administrative data. The common operational definition of a 'neighbourhood' used in Dutch housing studies is based on the four-digit unique postcodes with an average of 4,000 inhabitants²³. Such administrative data is reliable as every resident in the country is obliged to register her most current address with the local municipality of residence. Neighbourhood variables include the proportion of households from different ethnic background, the degree of urbanisation, average household size, and the percentage of households with children.

For the first-stage estimation, we have included relevant covariates according to the international and Dutch-specific housing price hedonic literature. This includes

²² Similar studies (Bajari and Kahn, 2005; DiPasquale and Kahn, 1999) have limited their sample to households who were living in the same dwelling for the last five years. According to our dataset, less than 2 percent of homeowners were dissatisfied with their current dwelling so we assume that transaction costs of moving to be negligible. There were also no major shocks to neighbourhood composition during this period – using administrative neighbourhood data, we found a median change in the number of non-western minority in a neighbourhood (as a proportion of total number of residents) to be around 5 percent between 1998 and 2008 (mean = 0.075 standard deviation = 0.076).

²³ The neighbourhood data is provided at the administratively defined 'neighbourhood' or '*buurt*'-level which is smaller than the statistical definition of neighbourhood based on the four-digit postcode. For our analysis, these neighbourhood variables have been aggregated to the postcode-level.

variables found in a standard real estate vacancy announcement: dwelling type (detached, semi-detached, corner, or terrace house and apartment), indoor and outdoor size, number of rooms, and availability of garden, car park, balcony, and central heating. Additionally, we control for the Dutch-specific single-storey access of primary dwelling chambers and the dwelling's construction period (pre-war or 1945, between 1945 and 1959, 1960 and 1969, 1970 and 1979, 1980 and 1989, 1990 and 1999, and 2000 and beyond). Besides our main neighbourhood variable-of-interest, share of non-western residents in a neighbourhood, we also include socioeconomic neighbourhood variables – average income per income-earner and the share of welfare benefit recipient – to control for household preference for neighbourhood characteristics beyond ethnicity. Although the dataset lacks information on commuting time, focusing on one city offsets this shortcoming. Moreover, we control for the type of neighbourhood ('urban-central', 'urban-outer-central', 'urban-green') that measures degree of urbanisation and proxies for 'locality' in the sense of distance to the city centre²⁴. All continuous variables – with the exception of the 'discretised' continuous variables such as number of rooms and proportion of welfare recipients (see subsection 2.4.1) – are natural log-transformed as prescribed by Bajari and Benkard's utility function specification (2005).

As for the second-stage estimation of marginal willingness to pay for an increase in non-western neighbours, we control for life-cycle demographic effect on housing demand using proxy variables: the head of household's age, household type (single, couple without children, couple with children, single parent with children, other) and size. To avoid omitted variable bias, we also account for the household's highest attained level of education and (standardised) disposable income – both variables most likely correlated with ethnicity and have an effect on household preference for neighbourhood composition. Our categorisation of 'ethnicity' in a broad sense includes generational status and is divided into: native Dutch, first-generation non-western, first-generation western, second-generation non-western and second-generation western.

The descriptive statistics of housing attributes by ethnicity are provided in Table 2.1, while household characteristics' descriptive statistics are provided in Table 2.2.

²⁴ Unlike North American metropolitan areas, spatial mismatch between residence and employment is not a significant issue in Dutch big cities due to their compactness, efficient public transportation, strong state intervention, and relatively low socio-spatial inequality (Musterd, 2005).

Table 2.1: Housing characteristics by ethnicity (column percentages)

	Native Dutch	Non-western	Western
Mean housing price (€)	233914	203359	260910
Mean indoor dwelling size (m ²)	111	110	124
Mean outdoor dwelling size (m ²)	70	48	75
Mean number of rooms	4	4	4
<i>Type of dwelling</i>			
Detached house	1.5	2.4	3.2
Semi-detached house	4.2	2.8	10.4
Corner house	6.7	6.7	5.8
Terrace house	24.3	29.6	24.1
Apartment	63.4	58.5	56.5
<i>Construction period</i>			
pre-1945	37.6	35.7	37.1
1945 to 1959	8.1	5.9	8.3
1960 to 1969	14.3	4.8	13.3
1970 to 1979	4.2	3.3	1.8
1980 to 1989	2.2	2.0	3.6
1990 to 1999	14.1	21.5	17.3
2000 and beyond	19.5	27.0	18.7
With shared/attached garden	52.5	52.0	63.7
With balcony	64.5	62.8	59.0
With car park/garage	16.0	15.0	21.9
With central heating	69.6	83.9	69.8
Single-storey access to main rooms	41.6	46.5	49.3
No single-storey access	58.4	53.5	50.7
<i>Neighbourhood type</i>			
Urban-central	2.8	2.0	2.5
Urban-outer central	90.5	93.9	88.1
Urban-green	6.7	4.1	9.0
Mean share of non-western residents	30.4	50.1	30.9
Mean income per earner (€)	30299	25346	31518
Mean share of welfare recipients	15.5	18.9	15.4
Number of observations	1095	460	278

Source: Dutch Housing and Living Survey (WoON) 2009 for The Hague, authors own calculation. Except for 'with balcony', we reject the test of independence for all variables at the five percent level based on the chi-square statistic for categorical variables and the one-way analysis of variance (ANOVA) Bartlett statistic for continuous variables.

Table 2.2: Household characteristics by ethnicity (column percentages)

	Native Dutch	Non-western	Western
Household type			
Single household	34.3	14.8	23.0
Couple with no children	32.1	17.6	30.2
Couple with children	27.4	53.3	41.7
Single parent	3.9	10.4	4.3
Non-family	2.4	3.9	0.7
Level of education			
Primary	1.28	10.7	1.4
Lower secondary	15.6	16.5	9.0
Higher secondary	31.1	36.3	29.9
Tertiary	52.0	36.3	59.7
Mean household size	2.2	3.1	2.6
Mean household income (€)	37395	35980	45018
Mean Age of household head	47	41	49
Number of observations	1095	460	278

Source: Dutch Housing and Living Survey (WoON) 2009 for The Hague, authors own calculation. 'Ethnicity' refers to ethnicity of household head. For all variables, we reject the test of independence at the five percent level based on the chi-square statistic for categorical variables and the one-way analysis of variance (ANOVA) Bartlett statistic for continuous variables.

Non-western minority homeowners in The Hague disproportionately live in newer housing units built after 1990. They seem to value outdoor dwelling size a lot less than native Dutch and western minority homeowners. On average, both native Dutch and western minority groups live in neighbourhoods where a third of its residents are of non-western background while non-western homeowners live in neighbourhoods where half are (in broad terms) 'co-ethnic' neighbours. Given these noticeable differences at the exploratory stage, we seek to see if they persist when control variables are accounted for with the results of our explanatory model presented in the next section.

2.6. Empirical results

2.6.1. First stage: Attribute-specific implicit prices

In the conventional, linear-additive parametric model, an explanatory variable's coefficient is interpreted as its average effect on the dependent variable while holding the other covariates constant. This is, however, more complicated in the

case of the full nonparametric model as the effect of an explanatory variable varies depending on the values of the other covariates. Without holding other predictors constant or at specific values, it is more useful to view the effect of an explanatory variable as a distribution rather than a point-estimate and report the summary measures for each of them. The nonparametric results for the first-stage housing price hedonic, i.e. the implicit prices, are provided in Table 2.3. As much as 92 percent of the variance in housing price is explained by the predictors. All the independent variables are found to be statistically significant at the five percent level using independent and identically distributed bootstrapped standard errors.

Table 2.3: First-stage: Price hedonic results

Housing price	Mean	Q1	Median	Q3	p-value
Non-western minority (log %)	-16848	-27146	-13683	-489	0.0276
Construction period	963	-902	0	2682	0.0000
Number of rooms	1096	-886	253	2320	0.0000
Indoor dwelling size (log m ²)	104487	65196	88575	131086	0.0000
Outdoor dwelling size (log m ²)	13993	6370	9510	16159	0.0050
Single-storey	766	0	0	0	0.0000
Garden	235	0	0	308	0.0000
Balcony	-2031	-4913	0	0	0.0000
Car park	5858	0	0	0	0.0000
Dwelling type	-7037	-12181	-3334	452	0.0050
Central heating	308	-545	0	827	0.0000
Welfare benefit recipient (%)	-472	-1550	-400	733	0.0000
Mean income per earner (log)	46490	-2751	32289	94357	0.0000
Living environment type	-527	-2027	-383	706	0.0000

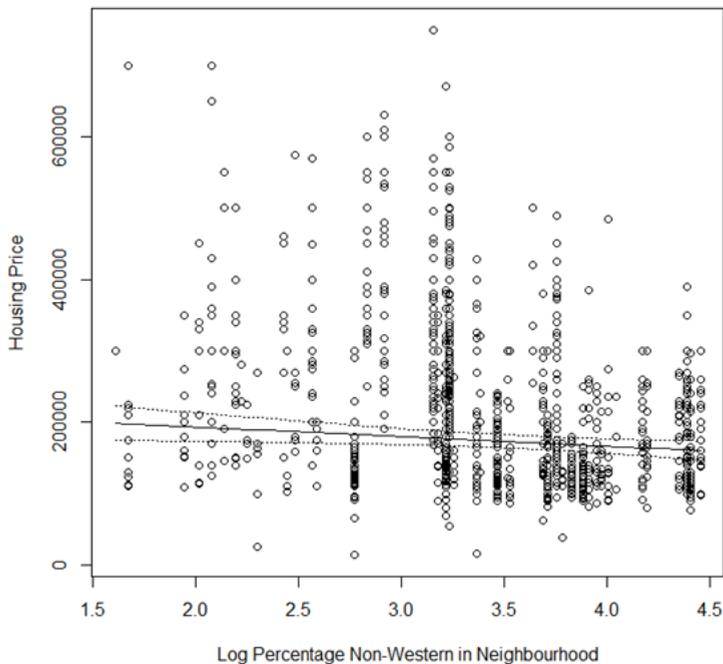
Note: Q1 and Q3 refer to the first and third quartile respectively. Bootstrapped p-values are from 399 replications using independent and identically distributed draws (i.i.d.). The R²-statistic is 0.92 while sample size equals 1145 observations.

Our model predicts an average decrease in dwelling price of €697 for every 10 percent increase in non-western neighbours²⁵. This is a sizeable effect, e.g. compared to the average increase of €45 in house price for each additional room. A more specific graphical presentation is given in Figure 2.1, which displays the scatter plot and partial regression plot of housing price on log percentage of non-western neighbours (with 95 percent confidence interval bands) when other housing and neighbourhood variables are held at their median or mode values. In the case of our homeowner sample for The Hague, the mode dwelling is an old, pre-1945 apartment with central heating measuring 100m² in indoor space and 20m² in outdoor space, a garden and balcony but without a car park, four rooms

²⁵ The marginal willingness to pay for a 10 percent increase in non-western neighbours is calculated as $\hat{\beta}_{i^*, nonwest} * (\log 1.1)$. $\hat{\beta}_{i^*, nonwest}$ in this case is estimated to be -16848 (see Table 2.3).

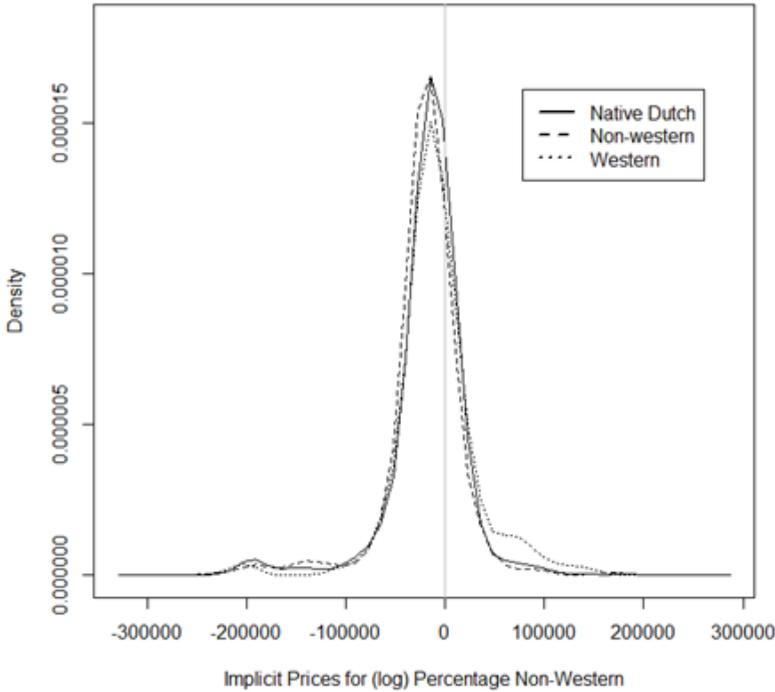
that do not share single-storey access, and is located in a ‘urban outer-central’ neighbourhood with an average income (per income earner) of €26,500 where 29 percent of its residents are of non-western minority background and 17.5 percent receive welfare benefits. The linear decreasing partial regression function in Figure 2.1 corresponds to Table 2.3 – that is, the average effect of non-western neighbours on housing price is negative when holding other covariates at their median and mode values. In addition, we note that the linear relationship here is imposed by the natural logarithmic transformation of the regressor based on our theoretical model. The fact that part of the implicit price distribution for some amenities such as central heating falls into negative value could reflect potential bundling constraints in the housing market. While counter-intuitive, it is not comparable to parametric estimates that report mean values only while holding other covariates constant (the latter assumption is also relaxed in our flexible nonparametric estimation). We recommend the mean and median value for interpretation of implicit price.

Figure 2.1: Implicit price of (log) percentage non-western neighbours



Note: Pointwise 95 percent confidence intervals are estimated based on the percentile (0.025, 0.975) bootstrap distribution from 100 replications.

Figure 2.2: Kernel distribution of implicit prices for (log) percentage non-western



For the different ethnicity groups, we present in Figure 2.2 the kernel distribution of the coefficients which one can collectively interpret as the implicit price for (log) percentage of non-western residents in the neighbourhood. It is a descriptive way of checking for potential heterogeneity in the demand for non-western neighbours (i.e. the larger the difference between the distributions, the more heterogeneity exists between the groups). Native Dutch and western minority households observe similar density functions (except for a fatter right tail distribution for western minority), while slightly more non-western households have a negative demand for non-western neighbours. As expected from the aggregated implicit price for non-western neighbours, we see that the majority of households have a negative demand for non-western neighbours. As comparison, kernel distribution of implicit prices for percentage of non-western minority by level of education is produced in Figure 2.4 in Appendix.

Concerning the other control variables in Table 2.3, we observe some intuitive estimation results. Homeowners have a higher willingness to pay if the house has more rooms, is larger (both inside and outside), and has single-story access to its primary chambers, a garden, car park and central heating. Finally, the higher the mean income per earner in a neighbourhood, the higher the mean housing price.

2.6.2. Second stage: Household marginal willingness to pay

The nonparametric results for the second-stage estimation for households' marginal willingness to pay (MWTP) for a 10 percent increase in non-western neighbours are provided in Table 2.4. Similar to the previous table of results, it reports the summary measures (e.g. mean and median) for the effect of household characteristics. Due to the log specification the dependent variable can be interpreted as a constant percentage change of a proportion, e.g. from 8 percent to 8.8 percent or from 80 percent to 88 percent.

Table 2.4: Second-stage: Household MWTP for 10% increase in non-western

MWTP for 10% increase in non-western	Mean	Q1	Median	Q3	p-value
Ethnicity	-4126	-4790	0	0	0.0025
Level of education	-1272	-4384	-565	2970	0.0451
Household size	-1308	0	0	0	0.0326
Household type	1150	-8109	0	13701	0.3133
Household income	-3960	-22035	-7569	19191	0.3133
Age of household head	2130	971	1229	2509	0.0000

Note: Q1 and Q3 refer to the first and third quartile respectively. Bootstrapped p-values are from 399 replications using independent and identically distributed draws (i.i.d.). The R^2 -statistic is 0.18 while sample size equals 1145 excluding missing values and outliers.

The results indicate that there is a statistically significant effect of household ethnicity and highest attained level of education on their preference for non-western neighbours. The mean effect of ethnicity across the various subgroups – first- and second-generation, non-western and western²⁶ – compared to the reference native Dutch category is -€4126. In other words, non-native Dutch homeowners in The Hague have a negative marginal willingness to pay of €4126 for a 10 percent increase in non-western neighbours. We also observe that at least a quartile (but less than half since the median is zero) of non-western and western minority homeowners in The Hague observe negative preferences for more non-western neighbours. The median effect of education attainment is negative on their willingness to pay for more non-western neighbours. Age of household head has a clear positive effect on household preference for non-western neighbours²⁷ but we do not find statistical significant results for household type and household income. The insignificant finding for homeowners in The Hague is in contrast with the results of Bolt and van Kempen (2010) who have found that native Dutch couple

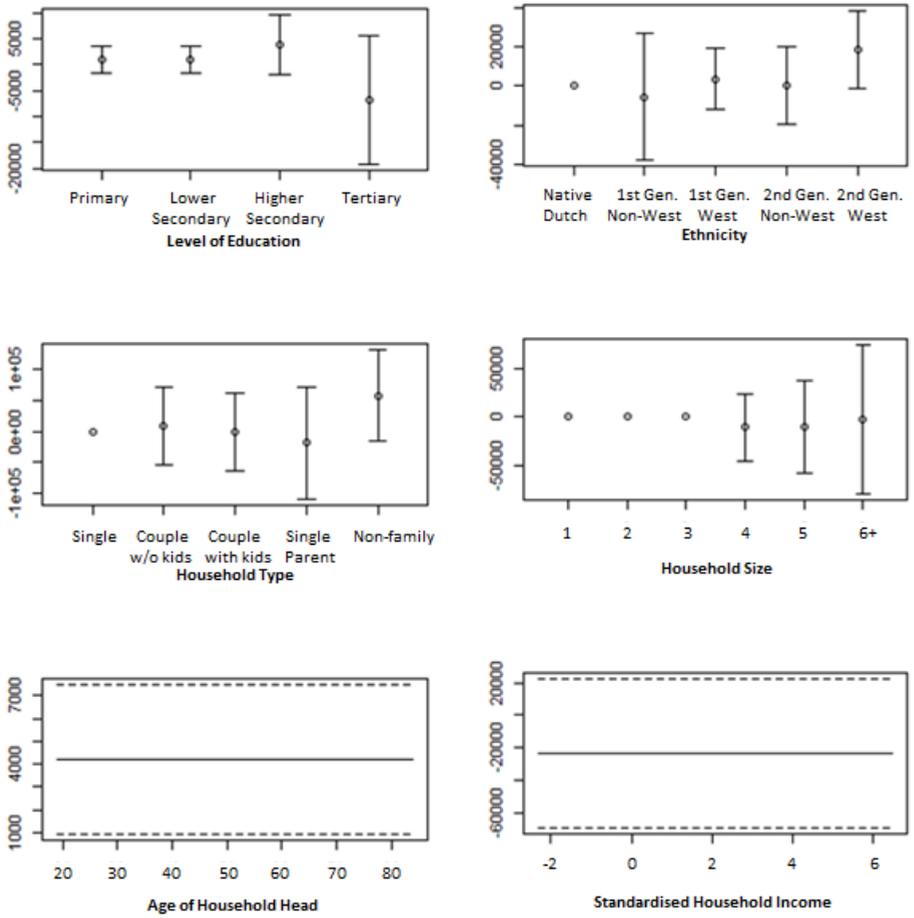
²⁶ The order of the ethnic subgroups besides the first (for the reference category) does not matter since 'ethnicity' here is entered as an unordered categorical variable.

²⁷ The positive age effect is expected since there are disproportionately more native Dutch homeowners who are both disproportionately older and more likely (compared to other ethnic groups) to be residing in neighbourhoods with more non-western households.

households with children and higher income households are far more likely to move into 'non-concentrated' neighbourhoods with less than 40 percent non-western residents (instead of 'concentrated' neighbourhoods).

To examine the conditional effects, we use the partial gradient plots in Figure 2.3 holding other covariates are at their median or mode values.

Figure 2.3: Partial gradient plots of WTP for non-western neighbours



Note: Partial gradient plots of willingness-to-pay while other covariates are held at their median or mode values. Pointwise 95 percent confidence intervals are estimated based on the percentile (0.025, 0.975) bootstrap distribution from 100 replications.

In Figure 2.3, the mode household in our sample is a native Dutch couple with children²⁸ with at least one parent being tertiary-level educated, its head of household aged 38, and disposable household income slightly below (0.3 standard deviation) the national household mean income. Homeowners of second-generation western background exhibit positive preference for more non-western neighbours compared to native Dutch households. Non-western minority households themselves, however, do not exhibit this preference for their (in broad terms) 'co-ethnics' when other predictors are held at their median or mode values. The first-generation non-western homeowners appear to have a slightly negative mean preference (but with large overlap in error bars) compared to native Dutch and other households.

So far we have collectively tested the ethnicity effect across the various subgroups using bootstrapped standard errors. To specifically test the effect of 'non-western' background on homeowner preference for non-western neighbours, we estimate an additional second-stage model using separate 'non-western' and 'western' ethnic variables. The summary measures of the MWTP by household characteristics are reported in Table 2.5 (for the corresponding partial gradient plots, see Figure 2.5 in Appendix). Compared to native Dutch and western minority homeowners, non-western homeowners in The Hague have a negative marginal willingness to pay of €6110 for a 10 percent increase in non-western neighbours. At least a quartile (but less than half since the median is zero) of non-western minority homeowners in The Hague observe negative preferences for more non-western neighbours. Hence, we argue that our results provide clear evidence of assimilation by *some* non-western households to purchase their homes in neighbourhoods with fewer co-ethnics, even after controlling for various housing, neighbourhood and household characteristics within our two-stage nonparametric framework. Previous findings in the Netherlands combining both the homeowner and renter samples have found that non-western minority households prefer to live with 'co-ethnic' neighbours (Bolt et al., 2008; van Ham and Feijten, 2008). While they have controlled for homeownership, they have not accounted for the interaction between homeownership and ethnicity which could partially explain the contradicting conclusions.

²⁸ We note that the median household size is 2 which is inconsistent with our mode household type of a couple with children, hence both variables in Table 2.4, Table 2.5, and the partial gradient plots should be interpreted with care. Nonetheless, the bootstrapped standard errors are still valid for hypothesis testing.

Table 2.5: Second-stage: Household MWTP for 10% increase in non-western

MWTP for 10% increase in non-western	Mean	Q1	Median	Q3	p-value
Non-western	-6110	-2942	0	0	0.0226
Western	2058	0	0	0	0.0426
Level of education	-1390	-5598	-847	3615	0.0727
Household size	-1580	0	0	0	0.0401
Household type	1078	-8882	0	13376	0.2782
Household income	-4183	-20281	-8928	17029	0.6065
Age of household head	1934	851	1232	1986	0.0050

Note: Q1 and Q3 refer to the first and third quartile respectively. Bootstrapped p-values are from 399 replications using independent and identically distributed draws (i.i.d.). The R^2 statistic is 0.17 while sample size equals 1145 excluding missing values and outliers.

2.7. Conclusion and policy implications

Previous research observed that households of migrant background have a preference or higher tolerance of living with their co-ethnics or other migrant groups, compared to the native or dominant group. This chapter contributes to this literature by taking into account the bundling nature of housing and neighbourhood attributes within a housing market, i.e. a household do not choose neighbourhood composition per se but rather trades it off with many other characteristics of different importance to the household. Using a flexible nonparametric framework makes our price hedonic model less susceptible to misspecification issues of parametric models. We apply a two-stage nonparametric framework to rich housing choice data for the Dutch administrative capital, The Hague.

Our model predicts an average decrease in dwelling price of €697 for every 10 percent increase in non-western neighbours when other housing and neighbourhood variables are held at their median or mode values. More importantly, we find statistically significant difference in household preference between native Dutch, non-western minority, and western minority homeowners. While the median non-western homeowner is relatively indifferent towards neighbourhood ethnic composition, the results suggest that at least some prefer *not* to live with more non-western households. Methodological differences aside, one potential reason behind this divergent result compared to other findings is our sample of homeowners only. Non-western minority households most likely self-select themselves into homeownership and it is this particular subgroup of non-western minority households that exhibit socio-spatial assimilation.

The evidence of assimilation by non-western minority homeowners is in line with the many fiscal and urban renewal policies of the Dutch government to encourage

homeownership and expand the owner occupation housing sector at the expense of the social rented sector. For ethnically integrated neighbourhoods, this finding supports the present Dutch housing policies. Further research on self-selection into homeownership and how to encourage homeownership among the relatively disadvantaged non-western minority groups could assist policymakers into reducing barriers of socioeconomic mobility and spatial assimilation.

2.8. Appendix

Figure 2.4: Kernel distribution of implicit prices for (log) percentage non-western

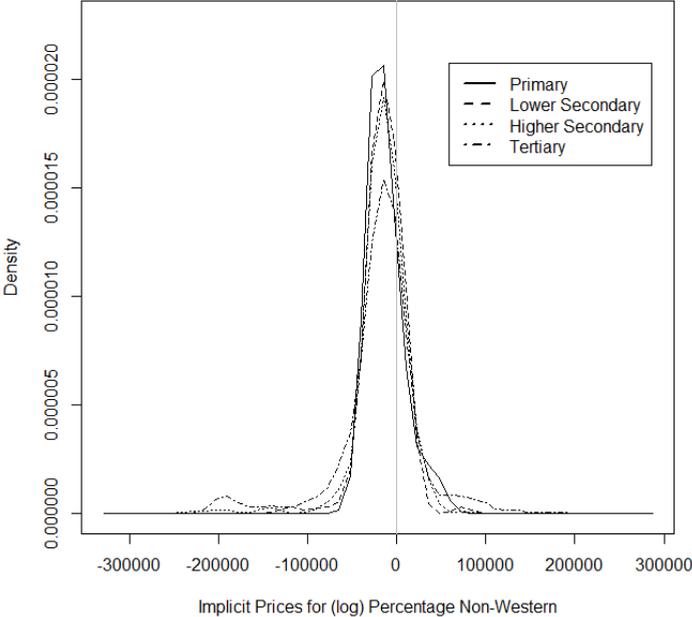
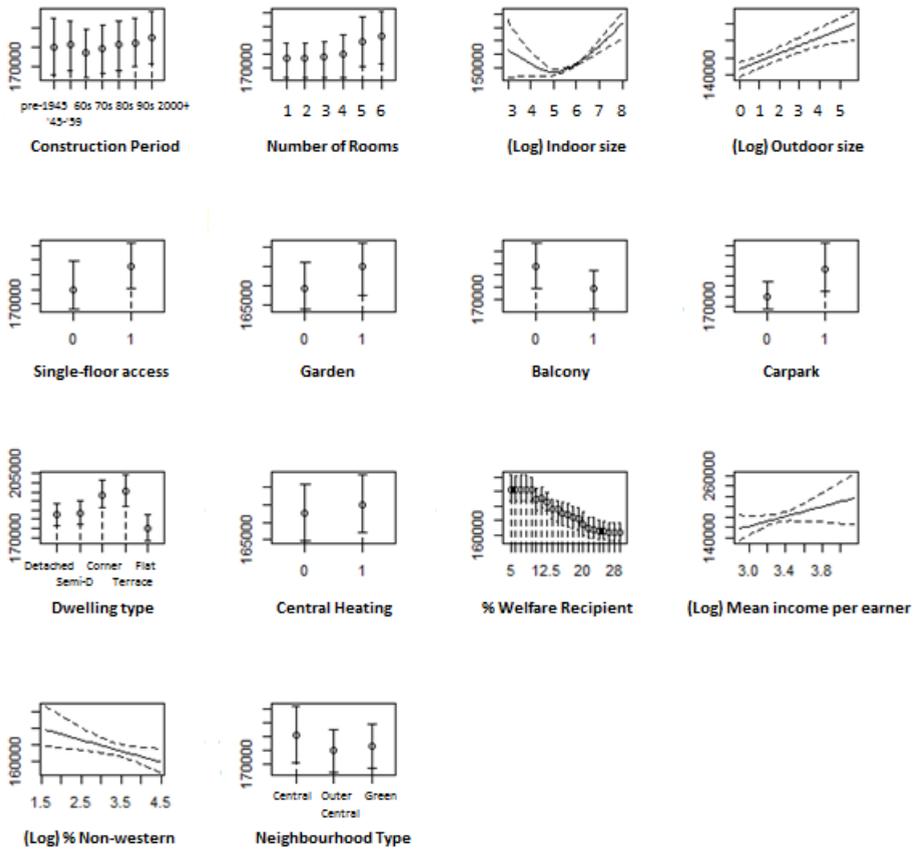


Figure 2.5: Partial gradient plots for housing and neighbourhood attributes



Note: Partial regression plots while other covariates are held at their median or mode values. Pointwise 95 percent confidence intervals are estimated based on the percentile (0.025, 0.975) bootstrap distribution from 100 replications.

3. School choice and segregation²⁹

3.1. Introduction

Complementing Chapter 2 on housing and neighbourhood choice, this chapter looks at school choice. Similarly, we ask if students prefer schools with more peers of their own ethnic and socioeconomic background. Like housing, school can also be seen as a heterogeneous good with a bundle of quality attributes, such as school type and residence-to-school distance, observable to the decision-maker. She would have to trade off the various attributes in order to select the school that generates the maximum utility for her within her choice set. Unlike housing, school choice deals with a relatively '*small number of discrete alternatives rather than different quantities of a divisible good*' (Radner and Miller, 1970). Hence, instead of a price hedonic approach, a discrete choice framework is more appropriate for modelling school choice.

So, how do students select themselves into schools? While this question appears trivial and answerable via a simple analysis of the observed school choices in a system of free school choice, it is not due to three reasons. First, the observed, aggregated student characteristics of the chosen schools do not reveal parental school choice but rather the school composition. While the latter influences and is influenced by school choice, it is not equivalent. School composition here is a static concept, while school choice is dynamic, subject to student mobility or transitions during the course of education (Cameron and Heckman, 2001; Declercq and Verboven, 2013). Second, focusing on the school choices of new students, i.e. students enrolling in the first grade, is not representative. Even in a system of free school choice, most schools have an admission policy that allocates the potentially scarce places, e.g. based on proximity to residence, sibling's enrolment, religion, and lottery. This makes it less about school choice but more about matching principles (c.f. the student assignment mechanism literature by Abdulkadiroğlu and Sönmez, 2003; Hastings et al., 2005). Third, students do not choose schools randomly. They follow an implicit nested decision-making structure in which the school denomination is preferred above other observed school characteristics. Ignoring this nested structure would result in biased (or at least, incomplete) evidence.

²⁹ This chapter is based on the paper: Ong, Cheng Boon, and Kristof De Witte. (2014). "School choice, segregation, and forced school closure." *UNU-MERIT Working Paper Series* (2014-008).

Exploiting a forced school closure setting, this chapter is able to focus on school choice as exogenously determined by a policy intervention. In particular, it examines the school choice of students in three Amsterdam primary schools that were forced to close in July 2007. The three schools had operated under the same school board, the Foundation for Islamic Primary Schools in Amsterdam (*Stichting Islamitische Basisscholen Amsterdam*, SIBA). The primary reason for the closure was the consecutive and deemed to be irreversible poor performance assessments by the Education Inspectorate (De Witte and Van Klaveren, 2012; Dijkma, 2007). The policy intervention was sudden with most of the affected students de-enrolling from the schools immediately after the closure and not before. School closures are very rare in the Netherlands and in this case, it is the indirect result of the discontinued public funding without which the schools were no longer financially viable. Consequently, our study augments the growing research field on school closures and its effects (De Witte and Van Klaveren, 2012; Egelund and Laustsen, 2006; Engberg et al., 2012).

Through school enrolment records, we also extract a sample of ‘early movers’ who had changed schools within two years prior to the forced closure to contrast their choice determinants with that of the forced movers. The former are students who have self-selected themselves into the three schools which were later forced to closed but have exhibited potential ‘Tiebout mobility’, i.e. by leaving the weakly assessed schools early for a presumably better school (Allen et al., 2010; Brunner and Imazeki, 2008; Hanushek et al., 2004; Tiebout, 1956). Our observations comprise of interschool mobility within the municipality so it is reasonable to assume that the school changes for these voluntary movers were more due to choice than to circumstance (e.g. a move out of the city). Through the two group comparison, we hope to isolate the actual determinants of school choice given an external shock such as forced school closure. The chapter is novel in the sense that it studies the school choices of involuntary movers which is expected to differ significantly from voluntary school choice.

Since the three schools are Islamic schools with predominantly students of Moroccan and Turkish background, our chapter contributes to the under-researched school choice literature for students of ethnic minority or migrant background. The increasing ethnic diversification of European cities due to immigration has led to substantial research interest in school choice and segregation (Allen, 2007; Burgess et al., 2005; Cantillon, 2009; Denessen et al., 2005; Karsten et al., 2006; Rangvid, 2007; Söderström and Uusitalo, 2010). Ethnically diverse, the city of Amsterdam makes an interesting case study for the determinants of primary school choice. First, with the Netherlands being a relatively new migrant-receiving country, there is significant difference in school choice between native Dutch students and those of ‘non-western’ migrant origin.

The latter typically refers to the four largest ‘non-western’ ethnic groups – Aruban and Dutch Antillean, Turkish, Moroccan, and Surinamese – with ethnicity defined by the parents’ country of birth. Next, without school catchment conditions and with per capita public funding for almost all schools, the Dutch school system approximates a universal voucher system (De Haan et al., 2011; Friedman, 1955) with clear parental choice-driven sorting into schools. Mediating the economic factor in school choice, non-socioeconomic school segregation has been sustained as parents choose according to other considerations such as religious denomination, educational philosophy, and student ethnic composition. The latter’s salience in school choice has been exacerbated by secularisation and the growing population of inhabitants with a foreign background (*allochtonen*) since the 1960s.

More than half of the primary school-attending children in Amsterdam are of non-western origin – 55.8 percent in 2007 – yet ethnic composition in schools reflects a far more segregated reality. According to the dissimilarity index score in Table 3.1, 56.6 percent of the non-western minority students in 2007 will need to change schools in order to achieve ethnic evenness at the city-level. The dissimilarity index is measured as the cumulative mean deviation in each school between the number of non-western pupils, weighted by its city-level population, and the number of native Dutch and western pupils, weighted by its city-level population (Duncan and Duncan, 1955).

Table 3.1: Ethnic segregation indices for Amsterdam primary schools

	2005	2006	2007	2008
Isolation Index	0.737	0.732	0.729	0.725
Exposure Index	0.263	0.268	0.271	0.275
Dissimilarity Index	0.574	0.571	0.566	0.560

Source: Municipality of Amsterdam (2005-2011) and CBS (2013b). Authors’ own calculation based on the Duncan and Duncan dissimilarity index (1955) and the isolation and exposure (or interaction) indices from Massey and Denton (1988).

Likewise, the interactive or exposure index is the cumulative product between the probability of a student being of a native Dutch and western background in each school and the probability of a student being of non-western background in a city (Massey and Denton, 1988). The isolation index as the converse of the exposure index is measured as the cumulative product between the probabilities of a student being of non-western background in the city and in each school. From both indices, we know that for the average non-western minority pupil in Amsterdam, 72.9 percent of her school peers will be of non-western background while the remainder 27.1 percent will be of native Dutch and western background. From a

policy perspective, our chapter's findings on disaggregated parental school preferences are useful for addressing aggregated issues such as school segregation.

We estimate a conditional logit model to exploit the large heterogeneity of primary schools in Amsterdam. It includes all school alternatives alongside their characteristics, including match-specific information such as residence-to-school distance. Then, we relax the conditional logit's independence of irrelevant alternative assumption by estimating a nested logit model so that the school-specific error terms within a 'nest' can be correlated with one another. This is crucial given the profile of our student sample that have all enrolled in an Islamic school – many of which still exhibited parental preference for staying within the Islamic denominational schools after the forced closure (ANP, 2007a). Demand has always exceeded supply in Amsterdam as local studies have found the percentage of parents preferring an Islamic denomination school to be 2.5 times that of students enrolled in the school type (van Kessel, 2000, 2003; as quoted in Karsten et al., 2006)

As a summary, our chapter's contributions to the existing literature on school choice are three-fold. First, we analyse the forced school closure and its effect on student mobility. Second, via the forced school closure and our second sample of 'early movers', we compare and contrast the school choices of those who had changed schools by choice and those who did so by circumstance, i.e. the forced closure. Lastly, we apply a nested logit model to analyse primary school choice as a decision nested upon school type or religious denomination.

In the following sections, we review the key literature on the determinants of school choice (Section 3.2) and the primary school system in the Netherlands (Section 3.3), before describing our data (Section 3.4), methodology (Section 3.5) and results (Sections 3.6 and 3.7). A final section concludes with several key lessons and a brief policy discussion.

3.2. Literature review

The following section summarises three main strands of literature relevant to school choice analysis: (i) the primary determinants of school choice; (ii) the use of stated preference versus revealed preference choice data; and (iii) the various discrete choice methods applied to school choice analysis. For brevity of this chapter and given our application on the Dutch school system, our review of school choice determinants is largely centred on the Netherlands.

One of the main determinants of primary school choice is school type or religious denomination (Allen and West, 2009; Driessen and Merry, 2006; Lankford and

Wyckoff, 1992). For example, it was the main factor behind the 1917 Dutch constitutional reform that finally led to public funding of private religious schools (Ritzen et al., 1997). Besides school type, proximity or distance between school and residence is also a robust predictor for school choice (Hastings et al., 2005; Kelchtermans and Verboven, 2010a, 2010b; Long, 2004; Ruijs and Oosterbeek, 2012).

Ethnicity matters (Burgess et al., 2005; Clotfelter, 1999; Karsten et al., 2006, 2003; Ladd et al., 2009; Ladd and Fiske, 2009a) – much more than most parents are willing to admit (Schneider et al., 2006; Schneider and Buckley, 2002). The distaste for schools with disproportionately more non-western minority students is apparent for both native Dutch and non-western parents themselves. Karsten and colleagues (2003) observe that parents regardless of ethnic background find predominantly ‘non-white’ schools in the neighbourhood – i.e. schools with 23 percent disproportionately less native Dutch students compared to the four-digit postcode area – to be ‘unsuitable’. It is also equally possible that ethnicity functions merely as a heuristic to parents for student ability, parental resources, and even teacher quality. With regards to the latter, schools with more disadvantaged or minority pupils could have difficulty attracting high quality teachers (Boyd et al., 2005; Clotfelter et al., 2005; Jacob and Lefgren, 2007). The disproportionately higher vacancy rates in schools with high share of non-western minority pupils coincides with the previous observation (Karsten et al., 2006; Ladd and Fiske, 2009a). In addition, the strong correlation between non-western background and low parental education could lead parents to proxy school peers’ parental resources with share of non-western pupils. There is also the ‘familiarity’ aspect as students have been found to ‘herd’ together with fellow primary school peers when selecting secondary schools (Ruijs and Oosterbeek, 2012).

Exploiting discontinuity at school district boundaries, Black (1999) estimates a 2.1 percent higher willingness-to-pay by parents for one standard deviation increase in school test scores. Lower school quality has also been found to increase the probability on parental decision to exit charter schools, more than regular public schools (Hanushek et al., 2007). School quality matters in the Netherlands as well (Koning and van der Wiel, 2013) but one study in Amsterdam using first preference school choice exposed some inconsistencies of this predictor (Ruijs and Oosterbeek, 2012), i.e. some of the school quality indicators were found to have either no effect or negative effect on school choice. Guided by previous literature, we aim to reduce the potential omitted variable bias in our empirical analysis by incorporating all the possible determinants of school choice.

As a second line of earlier literature on school choice, stated preference studies tend to overestimate the importance of education quality over other factors such as

racial and class peer composition (Schneider et al., 2006; Schneider and Buckley, 2002). In contrast, revealed preference research (see for instance Bayer et al., 2007; Hastings et al., 2005) accounts for: (i) the bias of survey respondents towards ‘socially accepted’ answers, (ii) the ‘bundling’ nature of school characteristics that needs to be trade-off with one another, and (iii) the constraints of regulation (e.g. catchment area) and school admission policies on parental choice. It is indeed a challenge for choice analysts to determine valid attributes that do influence choice selection because they are perceived subjectively by the decision-makers (Hensher et al., 2005). This is the main disadvantage of collecting revealed preference data from marketplace data such as school administrative records and not for instance, from the parents as decision-makers.

A third line of literature considers school choice as a discrete choice problem. Random utility models (RUM), first introduced by McFadden (1973) with extensions by Ben-Akiva (1974), Williams (1977), Daly and Zachary (1978), and McFadden (1978) are popular in the school choice literature. Due to the higher computational demands of the conditional logit, multinomial logit models have been favoured in earlier studies (e.g. Manski and Wise, 1983)³⁰. Nonetheless, the latter can forsake key information by aggregating alternative-specific attributes while focusing more on the characteristics of the decision-maker that influences choice (Long, 2004). Conditional logit models let the alternative-specific attributes to dictate choice. It also allows for pair-wise combined information between individual-specific attribute and alternative-specific attribute, such as residence-to-school distance, which is crucial for our study on primary school choice. As an extension of the conditional logit, nested logit models are common in the choice literature for tertiary education since it can account for the prior decision of whether or not to pursue post-compulsory education (Kelchtermans and Verboven, 2010a; Montgomery, 2002) – although the prevalence of the nested logit model with the ‘not attend’ option over the conditional logit model is contested by Long (2004). The mixed logit model is also an extension of the conditional logit model which, like the nested logit, relaxes the assumption of independence of irrelevant alternatives (Hastings et al., 2005; Ruijs and Oosterbeek, 2012).

3.3. School choice in the Netherlands

The Dutch school system places a strong emphasis on free parental choice of schools (Dronkers, 1995; Karsten et al., 2003; Ladd et al., 2009). The decentralised

³⁰ Random sampling of alternatives of the choice set (including the chosen alternative) is also a method to deal with the computational demands of the conditional logit estimations (Kelchtermans and Verboven, 2010b; Kohn et al., 1976) and its nested logit extension (Montgomery, 2002). See also the seminal paper by McFadden (1973).

school system in the Netherlands resembles a 'quasi-market' (Le Grand, 1991; see also Cornelisz, 2014) with public funding and private production of school services. Public funding of schools is allocated per capita with additional weights assigned based on parental education level. Schools with less than nine percent students in need of additional weighting are not provided more than per capita funding.

Primary education is part of the compulsory education for all children between the ages of 5 and 16. Typically, a student begins primary school education from age 4 although the enrolment process starts much earlier, e.g. from the age of 2 in some Amsterdam schools (Gemeente Amsterdam, 2013). Enrolment and admission policies are decentralised at the school-level although since 2009, there has been a trend for some schools in the same district towards harmonisation³¹. Some religious schools have a religious admission criterion. While students are not bound to their residential neighbourhood schools – i.e. no 'catchment area' like in the United Kingdom – schools can give priority to children living in the school's neighbourhood. Other priority rules in school admission include having siblings who are enrolled in the school, children of the school's employees, and the attendance of similar pre-school education type. The more popular, oversubscribed schools also allocate placements by lottery. Lastly, unlike the United States, homeschooling is virtually non-existent in the Netherlands (Blok, 2004).

While the Education Inspectorate reports and the national standardised test scores for schools are publicly available, the municipality has been working towards greater transparency. Since 2011, the Municipality of Amsterdam has, in cooperation of the local school boards, published annual school quality indicator reports for all primary schools which include learning skill- and subject-based test scores, quality assessment from the Education Inspectorate, turnover rate, student socioeconomic composition, and type of secondary school stream recommendations (Gemeente Amsterdam, 2011). The report allows for the direct comparison of schools and was aimed to improve the information asymmetry and efficiency of parental choice based on quality indicators. Similar information have been made publicly available much earlier, from the 1990s, to guide secondary school choice (Ruijs and Oosterbeek, 2012).

Choice within school closure

Primary school choice, however, is not limited to the first round of enrolment and is often a repeated decision-making event due to intentional or circumstantial school mobility (Alexander et al., 1996; Allen et al., 2010; Hanushek et al., 2004).

³¹ After several successful pilot projects, a centralised system at the municipality-level is underway (Gemeente Amsterdam and Amsterdamse Schoolbesturen Primair Onderwijs, 2013).

School mobility permits revealed preference choice analysis of new school choices and is more prevalent among non-western minority students in Amsterdam (see Table 4.3).

Given the limitation of our data, we do not observe schools' admission policies, i.e. the supply-side constraints that affect school choice. Karsten et al. (2003), for instance, discuss gate-keeping measures taken by the schools during enrolment process. It is reasonable, however, to expect potential receiving schools to be open to small numbers of enrolment. More so with the mediation of the municipality that had assisted the displaced students with their relocation into other schools (personal communication, 2013). For the purpose of this paper, we make the strong but justifiable assumption that the students were unconstrained in school choice in contrast to the initial school enrolment when students were matched to schools based on the priority rules as previously discussed. Even so, approximately 500 out of the 600 students affected had chosen to move en bloc to one school under the same school board (Inspectie van het Onderwijs, 2009a). This was an unexpected outcome of the policy intervention – to the disapproval of the then State Secretary for Education, Culture and Science who was in favour of integrating the students into other, less insular schools (ANP, 2007b). Temporarily, the students were allowed to stay in the same school buildings³². Nonetheless, there had been a complete change in school management, teachers, and other personnel.

3.4. Data description

For our study, we exploit school enrolment records provided by the Municipality of Amsterdam for the school years from 2005/2006 until 2010/2011. As many as 55,110 primary school students were enrolled in Amsterdam in July 2007. Between July 2005 and July 2007 when the forced closures took place, 665 students had been enrolled at least once in one of the three closed schools and had moved to another primary school within the municipality. For our final discrete choice analyses, observations with missing values in the battery of explanatory variables were excluded, leaving us with the final sample of 623 observations.

School alternatives in this chapter refer to schools at the locational level, i.e. a school with two separate locations will be considered as two school alternatives. Altogether, there are 206 primary school alternatives across the years but the

³² The larger two schools were renamed – *El Faroeq Omar* school became *IBS As-Siddieq (Zeeburg)* and *At Taqwa* school became *IBS As-Siddieq (Noord)* – and retained at original locations while students from the smaller *Abraham El Khaliel* school were absorbed by the other schools, including the original *IBS As-Siddieq (De Baarsjes)* school-location.

number varies between the years due to school closures and missing values in the covariates. The analysis were conducted separately for the two samples: the 'early movers' who had voluntarily changed schools within two years before the forced closure and the 'forced movers' who had to move to other schools after the closure. The latter group comprised a large subset of students who had collectively moved into one school that is managed by the same school board (Inspectie van het Onderwijs, 2009a). Although officially, 600 students were affected by the school closure, we only observe 486 of the 'forced movers' in our dataset as we focus exclusively on moves within the municipality and we exclude students who have since transitioned into secondary education. 'Early movers' comprise of 220 students who had changed schools within the municipality between July 2005 and June 2007.

In the selection of variables for the choice model, it is crucial to only include independent school attributes that actually differentiate the school alternatives from one another in the eyes of the parents as decision-makers (McFadden, 1973). The dataset contains student-level covariates – ethnicity, residential postcode, and unauthorised absenteeism experience (truancy). Individual-level information is used to calculate aggregated school-level variables such as population size, peer ethnicity, and truancy rate. Meanwhile, Haversine-based distance from residence to potential schools is estimated via longitudinal and latitudinal information at the four-position postcode-level. Due to outliers, we cap our distance-to-school variable at 10 kilometres³³. We were also provided test scores from the standardised national test (Cito) by the municipality but due to the lack of variation between schools, including this covariate did not alter much of our discrete choice analysis results.

Additionally, we have information on school type (i.e. teaching philosophy or religious denomination) and students' socio-economic status composition as measured by 2009³⁴ data on school funding weights for socially disadvantaged students. The latter pertains to public funding of schools which is allocated per capita and with additional weights assigned: 1.20 for students with at least one parent possessing primary-level education only; 0.30 for students with both

³³ Only 4.2 percent of the students in our sample attend a school that is more than 10 kilometres away from their residence.

³⁴ Unfortunately, the pre-2009 student weight data is unsuitable for our purpose due to the Ministry of Education's gradual implementation of the student weight definitions between 2006 and 2009 (Ministerie van Onderwijs Cultuur en Wetenschap, 2013). Up until 2006, additional weights were assigned by: 0.25 for native Dutch students with both parents having a maximum of lower vocational-level education; 0.40 for children of shipping crewmembers living away from the family; 0.70 for caravan-dwelling students; and 0.90 for first- and second-generation immigrants with at least one parent with a maximum lower vocational-level education or is unemployed, or the highest earning parent working in the manual or unskilled sector (Ladd and Fiske, 2009a).

parents (or the parent in-charge for primary care) having a maximum of lower vocational-level education (Rijksoverheid, n.d.). Given the large positive correlation between peer 'non-western' background and peer socioeconomic status as proxied by parental education (Pearson's product moment correlation = 0.86, p-value<0.000 for the very low education level, and 0.64, p-value<0.000 for the low education level), including both variables helps separate peer socioeconomic status from peer ethnicity when influencing school choice. Since additional funding is provided to schools with high proportion of socially disadvantaged pupils, we also include school personnel information to proxy for level of school resources. The earliest data provided by the Ministry of Education pertains to year 2008. We assume that both data on school funding weights and school staff (in fulltime equivalent) numbers did not fluctuate much between the years 2005 and 2008/2009. As a sensitivity analysis, the analysis was repeated with 2006 student weight data that only partially measures the proportion of low socioeconomic status students and the results were comparable except for the variable for peers with very low socioeconomic status.

More than half of the students in our dataset are of Moroccan descent while a quarter of them are of Turkish descent. The non-significant chi-square test of association between student ethnicity and moving status indicates the relative similarity between the subgroups. Proximity is crucial as 90 percent of them choose to attend a school that is within 500 metre away from their residences. In the bivariate table presented in Table 3.2, we compare the average student and receiving school characteristics of the two groups (and its subgroups) within our sample. It is apparent that students who chose to move en bloc to one school tend to live the closest to their new school while the potentially more selective early movers had moved to schools that are located further away. Truancy seems to be less of an issue for the early movers. Interestingly, truancy behaviour is more visible among those who did not move en bloc to the same school after the forced closure as nearly one out of five students have reported unauthorised absenteeism experience.

The vast majority (83 percent) of the forced movers had moved into an Islamic school while the distribution across the three school denominations is roughly equal amongst the early movers. There are 10 percentage-points more non-western peers in the receiving school for the forced movers than for the 'early movers' – this difference is largely driven by the main receiving school for the forced movers with a high 93 percent non-western student population. In contrast, forced movers who had moved to other schools ended up in schools with lower share of non-western peers and higher share of native Dutch and western peers. On the one hand, early movers appear more selective towards more native Dutch and western minority peers, smaller school size, lower truancy rate, and the higher level of

school resources (as measured by the managerial and teaching staff-to-student ratio). On the other hand, forced movers emerge to be more selective towards schools with higher average test score and lower proportion of students with low parental education background (as measured by the 0.3 student funding weight).

With its relatively large student population, the main receiving school for the forced movers has a significantly smaller managerial and teaching staff-to-student ratio compared to the average receiving schools chosen by the other students. Potentially, the low teacher-to-student ratio is compensated by its relative high proportion of support and administrative personnel. Those who chose to move to this school have the average shortest residence-to-school distance which could indicate a potential trade-off between the school characteristics. The subsequent section with the conditional logit and nested logit explanatory models could shed light on this possibility.

Table 3.2: Student and receiving school characteristics by moving status

	Early Movers	Forced Movers		
	All	All	SIBA	Other
<i>Ethnicity (%)</i>				
Native Dutch	2.3	2.7	2.5	3.6
Moroccan	60.0	58.9	61.0	48.8
Turkish	16.4	22.0	19.9	32.1
Surinamese	1.8	1.9	2.0	1.2
Antillean/Aruban	0.0	0.0	0.0	0.0
Other non-western	17.3	11.5	11.2	13.1
Western	2.3	2.7	3.0	1.2
With absenteeism experience (%)	5.0	12.1	10.7	19.1
Distance (in kilometre)	0.6	0.2	0.2	0.5
School characteristics				
<i>School type (%)</i>				
Public	37.7	9.7	0.0	56.0
Islamic	27.7	82.9	100.0	1.2
Christian	34.6	7.4	0.0	42.9
<i>Peer ethnicity (%)</i>				
Moroccan	39.9	46.2	49.5	29.7
Turkish	15.2	24.6	26.6	14.8
Surinamese	10.0	2.9	0.5	15.1
Other non-western	14.6	16.4	16.4	16.6
Native Dutch	14.5	4.2	1.6	17.0
Western	4.2	3.5	3.3	4.7
<i>Peer socioeconomic status (%)</i>				
Low SES (0.3 weight)	11.2	7.6	6.1	14.9
Very low SES (1.2 weight)	35.2	37.3	37.8	34.6
<i>Number of FTE staff per 100 student</i>				
Management	0.9	0.3	0.2	0.7
Teaching	7.5	6.1	6.0	6.8
Support/Administrative	2.3	2.5	2.7	1.8
School size	234.8	398.5	428.0	253.6
Truancy (%)	13.7	15.6	15.7	15.6
Sample size*	220	486	402	84

Source: Municipality of Amsterdam (2005-2011), MINOCW (2009), DUO (2007-2008), authors' own calculation. Receiving school variables refer to 2005 with the exceptions of socioeconomic status (2009), and school personnel (2008). Bold estimates indicate statistical significant difference at the 5% level between: (i) the early movers and (all) last movers; and (ii) among the forced movers, the SIBA-school and other schools.

*Maximum sample size which does not account for missing values on covariates.

3.5. Methodology

3.5.1. Intuition behind the conditional and nested logit framework

Each school within the municipality of Amsterdam is considered to be a different school alternative. Given that we do not fully observe school mobility outside of Amsterdam, our analysis includes only intra-city mobility and does not include an ‘out of Amsterdam’ alternative. Due to the large set of differentiable school choice alternatives (i.e. 206 different schools), a parent’s choice of primary school for their child³⁵ is estimated using a conditional logit model.

While its estimates report the likelihood of selecting a school with a given set of observed characteristics, the conditional logit model suffers from one major drawback – it does not allow for different substitutability or complementarity between alternatives with its assumption of independent and irrelevant alternatives (IIA). In our case, it is intuitive to see that when an Islamic school alternative is removed from or added to the choice set, the probability of selecting another Islamic school alternative changes disproportionately more than the probability of selecting a Public or Christian school alternative.

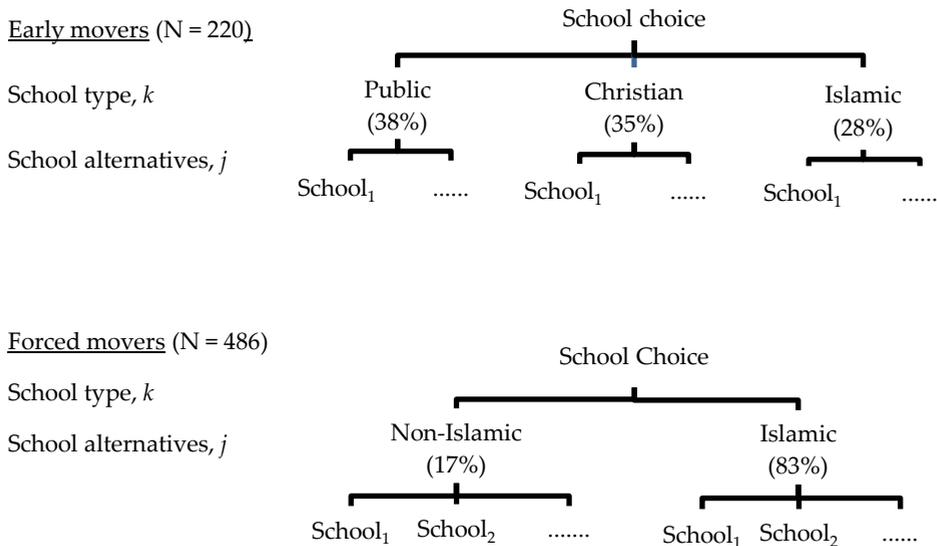
The mixed logit relaxes the assumption and allows for heterogeneous preferences for school characteristics but its lack of closed form solution creates computational limitations which we deem to be unnecessary for our relatively homogeneous student sample. Instead, the IIA assumption is relaxed in our study by means of a nested logit model which allows for the alternative-specific error terms within a ‘branch’ or ‘nest’ to be correlated with one another. The nested model does not imply a sequential decision-making process but it can be interpreted as such: parents as decision-makers prioritise the choice of school type or denomination before selecting schools within the school type based on a set of school attributes. To our best knowledge, our study is the first in applying a nested logit model to examine compulsory primary school choice that is nested within school type or religious denomination. Besides the composition of our unique sample of students enrolled in Islamic schools, we argue that parental choice for primary school is intuitively nested in the choice for school type. The failure to account for the decision’s nesting structure would otherwise bias our choice estimates.

Even so, the main disadvantage of the nested logit model when compared to the conditional logit model is that the latter permits the estimation of the effect of school type as a choice determinant. It is also a useful comparison should either

³⁵ In our chapter, we assume that school choice is made by the parents of the student and/or the student and use both terms interchangeably.

one of the nested logit models for our two sample groups be misspecified, i.e. that school choice is not nested on school type. Therefore, we estimate both the conditional logit and the nested logit probabilities of school choice for: (i) the ‘early movers’ who had changed schools within two years before the forced closure in July 2007; and (ii) the ‘forced movers’ who were forced to change schools after the forced closure (see Figure 3.1). Within a two-level nested logit model with school denomination as the nesting factor, the early movers can choose between three school types: public, Islamic, and Christian. We include school alternatives from other religious denominations in the last group, but since none of the non-Christian religious schools were selected by our sample, we can effectively consider this nest to be ‘Christian’. In view of the small proportion of forced movers selecting non-Islamic schools (17 percent), we only distinguish between those who had chosen the same Islamic school denomination, and those who had chosen ‘non-Islamic’ school types.

Figure 3.1: Nested logit model of school choice



Note: Number of observations includes those with missing values on some covariates.

Except for one student, all of the forced movers who had chosen an Islamic receiving school had moved en bloc to the same school – a policy outcome that contradicts the initial aim and policy line of the Ministry of Education. Conceptually, we can interpret the nesting structure to be one of reconcentration-

versus-dispersal behaviour by the students. The nesting structure is also consistent with the reality that most parents of the students from the closed schools were in favour of moving into an Islamic school instead of a non-Islamic school (as reported by ANP, 2007a).

3.5.2. School choice model

The intuitive description of Subsection 3.5.1 is formalised below to give a more precise description of school choice.

Conditional logit model

Let the utility that a parent, n , derives from choosing school alternative, j ($1, \dots, J$) to be U_{nj} (we follow the notations as in Train, 2003). Since we do not observe all factors that can influence one's utility in choosing school j , we define V_{nj} as the part of utility derived by parent n that is observable to the researcher and ε_{nj} to be the random error term that captures the unobserved factors affecting utility:

$$U_{nj} = V_{nj} + \varepsilon_{nj}. \quad (3.1)$$

Under the assumption of utility maximisation, the parent will choose the school that will offer the highest utility. By choosing school i , the derived utility must be higher than the utility offered by all other school alternatives, $U_i > U_j \forall j \neq i$. By assuming the error term ε_{nj} to be independent and identically distributed (i.i.d.) with extreme value distribution and utility as linearly additive, the random utility model can be conveniently estimated with the standard logit model (c.f. McFadden, 1973). Under the logit model, school choice is defined as a logit choice probability (expressed in its variance-scaled form) of parent n choosing school i ,

$$P_{ni} = \frac{e^{\beta' x_{ni}}}{\sum_j e^{\beta' x_{nj}}} \quad (3.2)$$

where $V_{nj} = \beta' x_{nj}$ and x_{nj} represents the vector of observable characteristics of school alternative j that affect utility of parent n . The estimated β coefficients measure the actual effect of each observed variable scaled to the variance of the unobservables. And so the interpretation of individual β coefficients should account for the fact that a lower coefficient does not necessarily indicate a smaller effect as it could be due to larger variance of the unobservables (Train, 2003).

Nested logit model

As elaborated previously, a nested logit model that relaxes the assumption of proportional substitution between school denominations seems more appropriate

for our study. Analogous to the previous model, if we now assume school alternatives j to be separable into K number of non-overlapping ‘nests’ (or school denomination in our case), B_k , the utility of parent n choosing school j can be decomposed into three parts:

$$U_{nj} = W_{nk} + Y_{nj} + \varepsilon_{nj} \quad (3.3)$$

for $j \in B_k$ where W_{nk} is the observable utility component common to all school alternatives in nest B_k , Y_{nj} denotes the observable utility component specific to each school j within nest B_k and ε_{nj} is the idiosyncratic error term (Train, 2003).

The probability for parent n to choose school i in nest B_k can be expressed as the product of the marginal probability of parent n choosing an alternative within nest B_k , P_{nB_k} and the conditional probability of parent n choosing school i in nest B_k conditional on choosing an alternative in nest B_k , $P_{ni|B_k}$:

$$P_{ni} = P_{ni|B_k} P_{nB_k}. \quad (3.4)$$

Employing the generalised extreme value (GEV) distribution of the error term ε_{nj} (Daly and Zachary, 1978; c.f. McFadden, 1978; Williams, 1977), the probability for parent n to choose school i in nest B_k can be estimated by a utility maximisation-consistent nested logit model. Under the nested logit, the i.i.d. condition still holds between the error terms of school alternatives in different nests:

$$cov(\varepsilon_{nj}, \varepsilon_{nm}) = 0 \text{ if } j \in B_k \text{ and } m \in B_l \text{ with } l \neq k. \quad (3.5)$$

But the error terms of different alternatives within the same nest are now allowed to be correlated:

$$cov(\varepsilon_{nj}, \varepsilon_{nh}) \neq 0 \text{ if } j, h \in B_k. \quad (3.6)$$

To estimate random utility model-consistent choice probabilities given the correlated error terms within a nest, the observable utility component specific to each school j within each nest, Y_{nj} needs to be normalised. This can be done via rescaling by the inverse of nest B_k 's dissimilarity parameter, λ_k (we refer to the elaboration by Heiss, 2002). Furthermore, this normalisation allows for the comparability across nests. Similar to the conditional logit before, the j school alternative-specific (rescaled) utility derived by parent n is estimated by a vector of observed school characteristics, x_{nj} : $Y_{nj}/\lambda_k = \beta'x_{nj}$. While the nest-specific utility, W_{nk} can be estimated by a vector of observable factors, z_{nk} common to all

alternatives within each nest, B_k : $W_{nk} = \gamma' z_{nk}$. Hence, the corresponding marginal and conditional probability logit models:

$$P_{nB_k} = \frac{e^{\gamma' z_{nk} + \lambda_k I_{nk}}}{\sum_{l=1}^K e^{\gamma' z_{nl} + \lambda_k I_{nl}}} \quad (3.7)$$

$$P_{ni|B_k} = \frac{e^{\beta' x_{ni}}}{\sum_{j \in B_k} e^{\beta' x_{nj}}} \quad (3.8)$$

where the inclusive value, I_{nk} is the log of the denominator of the conditional logit probability model that links the two logit probabilities:

$$I_{nk} = \ln \sum_{j \in B_k} e^{\beta' x_{nj}}. \quad (3.9)$$

Due to lack of information on the nest-specific factors, the z_{nk} vector is not estimated in this chapter. Instead we only estimate, in addition to the alternative-specific utility, the overall utility a parent n derives from ‘being able to choose the best alternative in the nest’ which is equivalent to the inclusive value, $\lambda_k I_{nk}$ (Train, 2003). In our application, the nested logit model estimates the following logit choice probability of parent n choosing primary school i given that they choose school denomination B_k :

$$P_{ni} = \left(\frac{e^{\beta' x_{ni}}}{\sum_{j \in B_k} e^{\beta' x_{nj}}} \right) \left(\frac{e^{\lambda_k I_{nk}}}{\sum_{l=1}^K e^{\lambda_l I_{nl}}} \right). \quad (3.10)$$

From this equation, it is apparent that the IIA condition with proportional substitution across alternatives still holds within each ‘nest’ or school type, but not between ‘nests’.

Following Heiss (2002), we specify the coefficient of the inclusive value, λ_k (also known as dissimilarity parameter) to be equal to $\sqrt{1 - \rho_k}$ with ρ_k measuring the correlation between the error terms of all alternatives within nest B_k . By this definition, a dissimilarity parameter value that is close to unity indicates more independence while a value close to zero suggests dependence or higher correlation between the unobserved utility components of the alternatives within nest B_k .

3.6. Determinants of primary school choice

The results of the conditional and nested logit estimates are presented in Table 3.3. As the results are complementary, we will discuss them simultaneously. The conditional logit and nested logit estimates concur with our expectation that, all

things equal, peer ethnicity matters when it comes to primary school choice. Both the early movers and forced movers prefer schools with more non-western peers – every percentage point increase in non-western minority peers is associated with a 2 percent increase in odds of school choice for an early mover and 7 percent increase in odds of school choice for a forced mover (as derived from $e^{0.02}$ and $e^{0.07}$ respectively). It is also much more pronounced in the nested logit model for forced movers when school choice is first nested on school denomination. Here, a one percentage point increase in non-western peers increases the odds of school choice by 14 percent, all else held constant. It is worth noting that our selected sample comprised of students who had enrolled themselves into ethnically segregated Islamic schools hence our estimates are not generalizable to the rest of the student population. We also cannot rule out the possibility that peer ethnicity is used merely as a heuristic device for parents to assess the school's overall student ability, parental resources, and teacher quality.

While peer ethnicity is an unambiguous determinant of school choice, peer socioeconomic composition has a mixed effect on school choice. First, early movers appear to be indifferent towards a school's proportion of students from socially disadvantaged background. Next, the effect of peer socioeconomic composition on the school choices of forced movers changes sign from negative to positive once school choice is defined to be nested on school type. The contradicting findings highlight the potential bias that arises when the appropriate nesting structure is not applied to a conditional logit model. All things equal, every percentage point increase in students of 'low' and 'very low' parental education background increases the likelihood of a forced mover selecting a school by 23 and 16 percent, respectively.

For every one percentage-point increase in its peer truancy rate, the likelihoods of selecting a school for the early movers and forced movers decrease by 4 percent and 15 percent respectively. Truancy here is measured by the proportion of students in the receiving school with unauthorised absenteeism experience. Distance between residence and school remains a robust determinant of school choice for both groups as parents prefer primary schools that are closer to home. When primary school choice is nested on school denomination, distance becomes a stronger determinant for the forced movers as every kilometre in additional distance reduces the odds of selecting a school by 76 percent.

School size matters only to the forced movers as the likelihood of choosing a school increases by 2 percent for every additional student. Controlling for school size and other factors, the early movers tend to choose schools with fewer teaching staff, while the forced movers appear to be indifferent towards it in the nested logit model. To explain the counter-intuitive finding, we allude to the fact that we have

not controlled for teaching quality and other likely sources of unobserved heterogeneity (Boyd et al., 2005; Clotfelter et al., 2005). The weighted student funding structure with its nine-percent threshold has been acknowledged for its positive bias towards schools with more disadvantaged students by providing additional resources commonly used to hire additional personnel (Ladd and Fiske, 2009a). A survey of primary school principals in the Netherlands in 1992 positively correlates school size with the probability of having one full-time school director (De Haan et al., 2011) – a factor that could improve overall school management and quality.

A consistent predictor for the forced movers, the number of support and administrative staff increases the likelihood of choosing a school by a factor of 3 for every additional personnel. Following our earlier hypothesis of students preferring larger schools for more managerial personnel, the number of managerial personnel has contrary effects on the early movers and forced movers. The former have a slight preference for schools with more managerial staff while the reverse is true for the latter. We posit two explanations for the forced movers' 'distaste' in this: (i) parents trade off school characteristics in selecting primary schools and the benefits of being in, for instance, an Islamic school, overrides the cost of not having a full-time school director; (ii) although all school personnel information is publicly available, school management is potentially less visible to parents and could be overlooked in their decision-making process.

From the conditional logit models, it is evident that both the early movers and forced movers do not distinguish between public and non-Islamic religious schools. This is not the case for Islamic schools – the likelihood of choosing one for the forced movers is 2.9 times the likelihood of choosing a public school, all else held constant. For the 'early mover' sample, importance of school type as a predictor depends on the model's battery of covariates since some schools – most notably, the three closed schools – are no longer observed in 2008/2009 on the school personnel and student weight funding variables (see Appendix Table 3.4). There is substantial interschool mobility between the three closed schools prior to the forced closure in 2007: 50 out of 209 observations within two years before the closure. A school's Islamic denomination is a statistically significant determinant of school choice for the 'early mover' sample only when we account for mobility between the three Islamic schools (compare Table 3.3 and the Appendix Table 3.4).

Nevertheless, the rejection of the independence of irrelevant alternatives assumption within the school denomination branch(es) for both nested logit models justifies its use over the conditional logit. The null hypothesis of this likelihood ratio test defines all the dissimilarity parameters in the nested logit model to be equal to one, $\lambda_k = 1 \forall k$. If that were to be true, the model collapses into

a standard conditional logit model. For the forced movers, the estimated dissimilarity parameter for the Islamic denomination schools of 0.143 corresponds to a very high correlation – approximately 0.9794 –between the error terms of the school alternatives³⁶.

3.7. Robustness checks

Since the likelihood ratio test in the nested logit model could be susceptible to the tree structure, the alternative Hausman-McFadden test is usually performed first on the conditional logit model to determine the necessity of a nested logit model (Hensher et al., 2005). The test's null hypothesis of IIA is rejected for the conditional logit model of the 'forced mover' sample ($\chi^2= 139.35$, p-value<0.000), i.e. removing one or a subset of alternatives does have a statistically considerable effect on the conditional logit estimates.

As mentioned before, there is substantial interschool mobility between the three schools prior to the forced closure. For the 'early mover' sample, the Hausman-McFadden null hypothesis is rejected for the 'early mover' conditional logit model when these interschool mobility observations are included ($\chi^2= 25.51$, p-value=0.008) but not when they are excluded. To account for the effects of the additional school personnel covariates, we have re-estimated the model without these covariates for the 'early mover' sample with and without interschool mobility between the three closed schools (using 2006 student weight data that partially observes peer socioeconomic composition). The comparability of results leads us to conclude that school choice is indeed subject to school type or denomination although we cannot ascertain if the nested logit framework (especially under the current three-category nesting structure) is necessary for the 'early mover' sample.

³⁶ We note that for both models, at least one of the dissimilarity parameters had a value exceeding unity which violates the *global* utility maximization assumption under the additive random utility model (Hensher et al., 2005). In any case, large dissimilarity parameters are prevalent in the discrete choice literature and we argue that our model could still be locally consistent under utility maximization, i.e. for a subset of alternatives in each nest, or for a constrained range of all possible values of our covariates (for further discussion on the issue we refer to the works of Börsch-Supan, 1990; Davis et al., 2012; Train, 2003).

Table 3.3: Conditional and nested logit estimates by moving status

	Conditional Logit		Nested Logit	
	Early movers	Forced movers	Early movers	Forced movers
<i>School type (ref: Public)</i>				
Islamic	0.55 (0.42)	1.04** (0.43)		
Christian	0.26 (0.17)	0.03 (0.27)		
School size	0.00 (0.00)	0.00*** (0.00)	0.00 (0.00)	0.02** (0.01)
Truancy rate (%)	-0.03** (0.01)	-0.05*** (0.02)	-0.04* (0.02)	-0.16** (0.07)
Non-western peers (%)	0.02*** (0.01)	0.07*** (0.01)	0.02** (0.01)	0.13*** (0.05)
Low SES peers (%)	-0.02 (0.01)	-0.06*** (0.01)	-0.01 (0.02)	0.21** (0.10)
Very low SES peers (%)	0.02* (0.01)	-0.03*** (0.01)	0.02 (0.01)	0.15** (0.07)
Total managerial staff (FTE)	0.21 (0.14)	-0.23 (0.18)	0.34* (0.20)	-3.55*** (1.20)
Total teaching staff (FTE)	-0.05*** (0.02)	0.07*** (0.02)	-0.07** (0.03)	0.14 (0.10)
Total support staff (FTE)	0.05** (0.02)	0.12*** (0.03)	0.03 (0.04)	1.10*** (0.29)
Distance-to-residence (km)	-0.49*** (0.09)	-0.52*** (0.08)	-0.59*** (0.21)	-1.43*** (0.29)
Log Likelihood	-761.563	-646.749	-758.673	-578.678
Akaike Information Criterion	1545.126	1315.499	1541.346	1179.356
Reject IIA assumption			yes	yes
Number of cases	160	463	160	463
Number of schools	195	196	195	196

Note: Two-tailed significance: *** $p < 0.01$, ** $p < 0.05$, * $p < 0.10$. Aggregated variables on receiving school refer to 2005 for the 'early movers' and 2006 for the 'forced movers'. For all samples, we use 2009 weighted student funding data on parental education, and 2008 school personnel data. Number of observations and school alternatives used in the analyses exclude those with missing values in any of the explanatory variables. Using the likelihood ratio chi-square test, we reject the null hypothesis of IIA within nests at the five percent significance level.

3.8. Conclusion and policy implications

This chapter exploits the forced closure of primary schools to examine the school choice of students in three segregated Amsterdam schools. While the school closure was caused by the schools' poor performance and administrative mismanagement, the selected schools comprised of students from predominantly non-western minority and disadvantaged background. The vast majority of the students who were forced to change schools chose to move en bloc to one school – an unintended and undesired policy outcome. Our study seeks to tease out the reasons underlying these school choices.

Despite the limited interpretation of our results to a specific student subpopulation, they contribute to the under-researched school choice literature for minority students in Western Europe. Quite intuitively given our select sample, school choice is nested in the choice for school type or religious denomination. Failure to account for the nesting structure in decision-making will lead to biased estimates, e.g. for peer socioeconomic composition. Besides the appropriate use of the school denomination nesting structure for the 'forced mover' sample, we also observe high student mobility between these three religious schools among the early movers. Like the forced movers, the voluntary movers prefer schools with more non-western students, less truancy behaviour among peers, and shorter distances from home. But unlike them, they do not retain a taste for peers of (most likely similar) low socioeconomic background after controlling for the additional school resources tied to the weighted student funding. They are also less concerned of school peers' truancy behaviour but seemed more selective towards schools with more managerial staff.

Our study provides some unique insights that could aid future policymaking namely, after an external shock of school closure: (i) students in segregated schools prefer re-concentration to dispersal; (ii) school choice of students is nested upon school type or religious denomination; and (iii) peer composition (in terms of ethnicity and socioeconomic status), distance, truancy, school size, and number of school personnel (managerial, support, and administrative staff) are relevant predictors for school choice. Similar policy interventions in the future should account for these school choice determinants, i.e. by ensuring the availability of desirable school substitutes to students, during the policymaking process.

3.9. Appendix

Table 3.4: Conditional logit estimates by moving status

Receiving characteristics	school	Early Movers		Forced Movers		
		(1)	(2)	(3)	(4)	(5)
<i>School type (ref: Public)</i>						
Islamic		1.35 (0.20)	0.55 (0.42)	3.00 (0.21)	1.04 (0.43)	-3.12 (1.19)
Christian		0.26 (0.17)	0.26 (0.17)	0.59 (0.25)	0.03 (0.27)	-0.38 (0.27)
School size		0.00 (0.00)	0.00 (0.00)	0.01 (0.00)	0.00 (0.00)	0.01 (0.00)
Truancy rate (%)		-0.02 (0.01)	-0.03 (0.01)	-0.06 (0.01)	-0.05 (0.02)	0.00 (0.02)
Non-western peers (%)		0.04 (0.00)	0.02 (0.01)	0.12 (0.01)	0.07 (0.01)	0.00 (0.01)
Low SES peers (%)		-0.03 (0.02)	-0.02 (0.01)	-0.11 (0.02)	-0.06 (0.01)	0.12 (0.02)
Very low SES peers (%)		-0.08 (0.02)	0.02 (0.01)	-0.29 (0.03)	-0.03 (0.01)	0.03 (0.01)
Total managerial staff (FTE)			0.21 (0.14)		-0.23 (0.18)	0.30 (0.21)
Total teaching staff (FTE)			-0.05 (0.02)		0.07 (0.02)	-0.10 (0.03)
Total support staff (FTE)			0.05 (0.02)		0.12 (0.03)	0.02 (0.05)
Distance-to-residence (km)		-0.44 (0.06)	-0.49 (0.09)	-0.56 (0.08)	-0.52 (0.08)	-0.56 (0.11)
Log Likelihood		-964.872	-758.149	-746.379	-623.712	-328.982
Akaike Information Criterion		1945.745	1538.298	1508.759	1269.424	679.964
Pseudo R ²		0.1295	0.0957	0.6983	0.7448	0.1451
Number of cases		209	159	466	463	75
Number of schools		201	195	202	196	196

Note: Aggregated variables on receiving schools calculated in years 2005 for the ‘early movers’ and 2006 for the ‘forced movers’. We use 2009 weighted student funding data on parental education and 2008 school personnel data. Number of observations and school alternatives exclude those with missing values in any of the explanatory variables. Model (5) excludes ‘forced movers’ who had moved en bloc to one school. The difference between Models (1) and (2) is driven by students moving between the three closed schools prior to their closure.

4. Peer effects in schools³⁷

4.1. Introduction

Chapter 3 impresses upon us the segregated reality of Dutch primary schools, especially in big cities. More than half of the primary school-attending children in Amsterdam are of non-western origin yet 56.6 percent of them in 2007 will need to move into ‘whiter’ schools in order to achieve ethnic evenness at the city-level. As freedom of school choice is enshrined in the national constitution, the fundamental issue with school segregation lies in its possible effects on the students’ educational outcomes. The following chapter explores the potential long-term effect of ethnic peer composition at primary school on one’s likelihood to early school leaving.

‘Few events in the adolescent life course determine subsequent social and economic opportunities more than dropping out of school’ (Crowder and South, 2003, p. 660). In a developed, knowledge-driven society, high school dropout is a subject of policy and research with growing importance – c.f. the European Council’s target for lowering average rate of high school dropout to below 10 percent. ‘Early school leavers’ can be defined as *‘people aged 18 to 23 who have only lower secondary education or less and are no longer in education or training’* (European Council, 2003). Lack of economic opportunities aside (Rumberger and Lamb, 2003), early school leavers are also positively associated with various delinquent behaviours (Anderson, 2012; Hirschi, 1969), teenage pregnancy (Black et al., 2008), lower life expectancy (Kindig and Cheng, 2013), and overall lower lifetime wealth, health quality, and happiness (Oreopoulos, 2007).

The determinants for high school dropout are numerous, multi-levelled, and complexly intertwined (for in-depth reviews, see De Witte et al., 2013; Murnane, 2013; Rumberger, 2011). Not to be studied in isolation, high school dropout is ‘the culmination of a long-term process of academic disengagement’ (Alexander et al., 1997). It is often, but not necessarily, preceded by academic underachievement and various forms of noncompliant behaviour such as truancy, absenteeism, disruptive conduct in class, and delinquency (Alexander et al., 1997; Brooks-Gunn et al., 1993; Cairns et al., 1989; De Witte and Csillag, 2012; Finn and Rock, 1997). Underlying this process of academic disengagement are socioeconomic ‘risk factors’ such as low income or minority status (Entwisle and Alexander, 1993). If left unmediated

³⁷ This chapter is based on the paper: Ong, Cheng Boon, and Kristof De Witte. (2013b). “The Influence of Ethnic Segregation and School Mobility in Primary Education on High School Dropout . Evidence from Regression Discontinuity at a Contextual Tipping Point.” *UNU-MERIT Working Paper Series* (2013-064).

by external factors such as state intervention, schools largely reflect and reproduce the social inequities in society.

One growing facet of this line of research looks at the influences of student and peer ethnicity. Exploiting historical data and a legal-political intervention, Guryan (2004) found that desegregation policies in the 1970s have led to small decrease in the dropout rate of African American students. While in Israel, Gould and colleagues did not find statistically significant effect of immigrant peers on the dropout probability of native students, although there is immigrant peer effect on native students' matriculation test outcome (Gould et al., 2009). However, most earlier literature on school dropout ignored peer effects and was limited to examining ethnic differences in dropout behaviour (Cameron and Heckman, 2001; Cataldi and KewalRamani, 2009; Griffin, 2002; Kalmijn and Kraaykamp, 2003; Ream and Rumberger, 2008). Driscoll (1999) also found generational differences, i.e. third generation Hispanic students have higher dropout probability than those from first- and second-generation after controlling for family resources and background.

More insights on school peer effects³⁸ can be gained from the broader education (economics) literature. Van Ewijk and Slegers (2010a, 2010b) conclude in their meta-analyses that both socioeconomic and ethnic peer effects matter. For school peer ethnicity, the effect tends to be mixed, conditional to the student's own ethnicity. Few studies did find significant immigrant peer effect on native students' educational outcome (Brunello and Rocco, 2012; Gould et al., 2009; Jensen and Rasmussen, 2011). Jensen and Rasmussen (2011) established that there is negative immigrant peer effect on native Danish students' test score in mathematics but not on migrant students' own results in reading and mathematics. Even so, the majority of literature concurs on the conclusion that share of peers of disadvantaged or immigrant background have a larger effect on students of the same background, and a considerably smaller, if at all, effect on the advantaged or native background students (Angrist and Lang, 2004; Geay et al., 2013; Guryan, 2004; Hanushek et al., 2009; Hoxby, 2000; Ohinata and Ours, 2011; Peetsma et al., 2006; Schneeweis, 2013; Van Ewijk and Slegers, 2010a). For instance, Ohinata and van Ours (2011) do not find peer effects of immigrant children in class on the educational outcomes of native Dutch students but found an adverse effect on the language test scores of immigrant children themselves. For brevity of this chapter,

³⁸ 'Peer effect' in this chapter refers to Manski's (1995) terminology of 'contextual effect'. This effect is driven by the distribution of exogenous background characteristics such as ethnicity in the reference group, i.e. the primary school in our study. Due to the limited scope of the chapter, 'ethnic peer effect' is treated as a proxy to these unobserved wider influences. See also Thrupp et al. (2002) for a discussion.

we refer for a broader discussion on peer effects to the excellent reviews by Jencks and Mayer (1990; 1989), Sampson et al. (2002), and Durlauf (2004).

Moreover, various studies have confirmed the undesirable effects of frequent mobility between schools. Frequent mobility is correlated to a higher risk of dropout from high school (Astone and McLanahan, 1994; Coleman, 1988; Gasper et al., 2012; Ream and Rumberger, 2008; Rumberger and Larson, 1998) and lower educational achievement (Alexander et al., 1996; Hanushek et al., 2004; Mehana and Reynolds, 2004; Pribesh and Downey, 1999; Temple and Reynolds, 2000). Whereas school mobility is typically calculated over the course of high school attendance (e.g. Gasper et al., 2012; Rumberger and Larson, 1998), we measure school mobility during primary schooling. Doing so, we avoid the disadvantage of using the more contemporaneous measure of high school mobility given its potential endogeneity with high school dropout. As noted by Bowditch (1993), the same factors used to identify students ‘at-risk’ of dropping out – such as disruptive behaviour in class and truancy – can be used by schools to ‘push out’ students who are considered as ‘troublemakers’.

Socially disadvantaged students – as measured by African American minority status, receipt of school meal subsidies, and mother’s low level of education – were found to have a higher probability in changing schools (Alexander et al., 1996). The effect of changing schools can be heterogeneous, conditional on the student’s personal and peer characteristics. Looking at both individual student mobility and aggregated mobility Hanushek et al. (2004) observe larger negative externalities of student mobility for ethnic minority students who disproportionately change schools more often and attend schools with higher turnover than ‘white’ students.

This chapter contributes to the literature in two ways. First, we investigate ethnic heterogeneity in the propensity of school dropout in secondary education. We also examine how ethnic heterogeneity interacts with the influence of primary school student mobility and the ‘contextual effect’ (c.f. Manski, 1995) of peer ethnicity at the primary school-level. Mainly due to data limitations, earlier literature on high school dropout has ignored the influence of primary school factors. Using administrative data linking primary school and high school records, we aim to fill this research gap.

Our second contribution involves the testing of the ‘contextual tipping point’ effect of non-western peer composition on the likelihood of high school dropout. ‘A contextual tip occurs when a gradual change in the value of one variable leads to a discontinuous jump in some other variable of interest’ (Lamberson and Page, 2012). In contrast, our methodology is largely inspired by the ‘direct tipping point’ search procedures expounded in Card et al. (2008a) that have both dependent and

independent variables derived from the same variable. To our best knowledge, this study marks the first tipping point estimation in the research field of school dropout. Using high-order polynomial regression and a regression discontinuity design, we deduce and statistically test the 'contextual tipping point' of share of non-western school peers from which the propensity to dropout increases exponentially for native Dutch students. Assuming that parents and students do not observe this 'contextual tipping point' and do not self-select into schools at either side of the threshold, we alleviate the omitted variable bias and establish causality between the share of non-western peers and early school leaving.

The remainder of the chapter is structured as follows. Section 4.2 introduces the Dutch education system and the issue of ethnic segregation in schools. Section 4.3 describes our specially compiled dataset from various sources including school records and neighbourhood administrative data. Section 4.4 estimates the relationship between school mobility, ethnic peer effect, and school dropout and explores the potential 'contextual tipping point' effect of peer ethnicity. Section 4.5 concludes.

4.2. The case of Amsterdam and its school system

Besides the availability of rich school and neighbourhood data, the city of Amsterdam provides a suitable testing ground for the association between ethnicity, school peer ethnicity, school mobility, and early school leaving. First, as a relatively new 'migrant-receiving country', there is significant difference in dropout rates between native Dutch students and those of 'non-western' migrant origin. The latter typically refers to the four largest 'non-western' ethnic groups – Antillean and Dutch Aruban, Turkish, Moroccan, and Surinamese – with ethnicity defined by the parents' country of birth. Next, without school catchment conditions and with per capita state funding for almost all schools, there is clear parental choice-driven ethnic sorting. On the one hand, equalised state funding for private and public schools with additional weights based on students' socioeconomic and 'foreign' background have mediated the economic factor in school choice (Ladd and Fiske, 2009b). On the other hand, non-socioeconomic school segregation has been institutionally permissible and sustained as parents choose according to other considerations such as religious denomination, educational philosophy, and student ethnic composition. The latter's salience in school choice has been exacerbated by secularisation and the growing population of inhabitants with a foreign background (*allochtonen*) since the 1960s – making The Netherlands an interesting case study for ethnic segregation in schools.

Sykes and Musterd (2011) find a strong and significant effect of schools' socioeconomic composition on educational outcomes in the Netherlands,

mediating to a large extent, initial residential neighbourhood effects. We expect a stronger effect for Amsterdam, an ethnically diverse city with the average primary school having more non-western minority students than native Dutch and western minority student (see Table 4.1). In 2000, one in four non-western primary school pupils are enrolled in a school where the share of non-western minority students approaches ninety percent (own calculations using Municipality of Amsterdam data).

Table 4.1: Relative size of ethnic groups, 2000 in row percentage

Age Group/ Region	Native Dutch	Moroccan	Antillean -Aruban	Surinam	Turkish	Other Non- west	Western
4-12 years Amsterdam	33.63	16.58	2.51	15.81	9.63	12.00	8.84
All ages Amsterdam	55.62	7.48	1.52	9.74	4.61	7.73	13.30
4-12 years Netherlands	79.00	3.03	1.09	2.65	3.46	4.35	6.43
All ages Netherlands	82.51	1.65	0.68	1.91	1.95	2.70	8.61

Source: CBS (2010b)

Unlike general education systems found in the United States and the United Kingdom, high school education in the Netherlands is divided into multiple tracks (see Figure 4.4 in Appendix) with the mainstream ones divisible into: (i) the general tracks; and (ii) the vocational tracks. They are hierarchical based on student ability (proxied by test scores and teacher's recommendation) and susceptible to ethnic sorting (Kalmijn and Kraaykamp, 2003). Although we do not analyse 'downward mobility' in educational track, we account for its effects in our section on early school leaving.

4.3. Data and descriptive statistics

Our main data originate from a rich school administrative dataset provided by the Municipality of Amsterdam. It comprises the universe of students aged four to thirteen³⁹ who were enrolled in 241 primary schools in Amsterdam in 2000. For 46,652 of our observations, we have information on student demographics – gender, ethnicity, residential postcode (up to the six-position detail), educational

³⁹ Despite the official primary school age from 4 to 12 years, we kept the thirteen year-olds because many (more than 8000) had passed their 13th birthday when they de-enrolled from primary school.

track⁴⁰, and whether one is from a single-parent family – and school characteristics such as location and size. The detailed postcode information for both school and residence allows us to measure the student’s distance to school⁴¹. With enrolment records, we also observe student’s inter-school mobility in Amsterdam over time.

The data tracks the educational career of these students through secondary education. While the majority of the students graduate by the end of the dataset, i.e. year 2008, 8.4 percent of students end up as school dropouts. Our operational definition of a high school dropout is someone who has left the school system without obtaining a higher secondary diploma. Since we do not observe the students in our sample (i.e. those enrolled in primary school in 2000) until the age of 23 – but only until the age of 20 – the observed event of high school dropout is right-censored. We account for this in our empirical analysis using cohort dummy variables.

The data have been enriched with information from three additional sources. First, in order to avoid measurement error in high school dropout and using unique student identification numbers, we combined the dataset to a nationwide register dataset with information on school dropout (Basis Register Onderwijs Nummer or BRON data). As a result of both sources of administrative data, we avoid endogeneity issues arising from measurement errors.

Bivariate statistical analyses in Table 4.2 show a positive association between the likelihood of high school dropout with being female, ethnicity (for those of Dutch Antillean, Aruban, or other non-western origin and those of 1st generation migrant background), single parenthood, and vocational and pre-adult education tracks. Native Dutch students have on average a lower dropout rate (7.1 percent) compared to those of foreign background – between 8.2 percent for students of Moroccan and Turkish origin to 12.7 percent for those of Dutch Antillean or Aruban origin. As expected, first-generation migrant students have a significantly higher dropout rate compared to second-generation migrant students. High school students enrolled in the vocational (MBO) track have a disproportionately high

⁴⁰ We use the following classification: pre-vocational secondary education (VMBO) and the special education stream within it for those with learning difficulties (LWOO), general secondary education (HAVO), pre-university secondary education (VWO), prolonged general adult education (VAVO), elementary vocational training (PRO), transitory education for inter-secondary education programmes (BRUG), and vocational education (MBO). See Figure 4.4 in Appendix for a schema of the Dutch education system.

⁴¹ Although we do not have information on the exact address of the student, the six-position postcode provides detailed information on the location of the student. This limits the measurement error in measuring distance to the school.

rate of dropout at 23.5 percent, while dropout only afflicts about 2.5 percent of pre-university (VWO) and general secondary (HAVO) students.

Table 4.2: Descriptive statistics in row percentage

	Non-dropout	Dropout	Total
Native Dutch	92.86	7.14	16,144
Antillean/Aruban	87.28	12.72	967
Surinamese	89.06	10.94	7,013
Moroccan	91.79	8.21	9,012
Turkish	91.76	8.24	5,070
Other non-western	90.87	9.13	5,347
Western	91.26	8.74	3,594
VWO (pre-university)	97.62	2.38	8,665
VMBO (pre-vocational secondary)	91.86	8.14	9,372
MBO (vocational)	76.52	23.48	7,880
HAVO (general secondary)	97.42	2.58	5,154
LWOO (special needs pre-vocational)	91.82	8.18	6,984
Brug (bridge-class)	95.31	4.69	7,817
PRO (elementary vocational training)	91.00	9.00	1,200
pre-VAVO (pre-adult education)	88.30	11.70	94
Female	93.10	6.90	23,327
Male	89.94	10.06	23,839
Native Dutch	94.53	7.15	16,146
1st generation	90.16	13.38	3,930
2nd generation	91.42	8.58	27,060
Two-parent household	92.03	7.97	42,394
Single parent household	86.78	13.22	4,772
Total observations*	91.50	8.50	47,166

Source: Municipality of Amsterdam and BRON data (2000-2008), authors' own calculations. *Maximum total observations which does not account for missing values on covariates.

Second, our dataset has been enriched with data from the Ministry of Education on school type (i.e. teaching philosophy and religious denomination) and students' socio-economic and foreign background composition as measured by 2005 data on school funding weights for socially disadvantaged students⁴². The latter pertains to public funding of schools which is allocated per capita and with additional weights assigned: 0.25 for native Dutch students with both parents having a maximum of lower vocational-level education and 0.90 for first- and second-generation immigrants with at least one parent with a maximum lower vocational-level

⁴² We do not have school funding data for 6 percent of our observations.

education or is unemployed, or the highest earning parent working in the manual or unskilled sector (Ladd and Fiske, 2009a)⁴³. Using the information on the student weights, we construct a new compositional school variable for the proportion of all students with low socioeconomic background. The variable is based on parental education (and employment status for those of migrant background). Correlation is high between the new variable and proportion of non-western students (Pearson's product moment correlation = 0.8656, p-value<0.000) but this is mitigated by our use of categorical dummy variables for the latter. Given the high correlation between socioeconomic status and 'non-western' ethnic background, including this crucial variable helps us to control for socioeconomic peer effects in order to obtain actual ethnic peer effect on the probability of school dropout.

Third, using the residential postcode, we link the data to 2004 'block'-level neighbourhood data based on the smallest six-position-postcode identifier, and 'zipcode'-level neighbourhood data based on the four-position-postcode from Statistics Netherlands (CBS)⁴⁴. Relevant neighbourhood data include the level of urbanity, number of inhabitants, average housing price (assessed by the municipality authority for taxation purpose), mean level of income, and compositional information over ethnic group ('native Dutch', 'non-western', and 'western'), age group, welfare recipient status, and household type (single-person, household with or without children). In the Netherlands, administrative data on the highest obtained education level and occupational type of parents do not exist. We subsequently proxy household income – and to a lesser extent, parental education and occupation type – with block-level (or six-position-postcode) average individual income from wage, welfare benefit, and pension. The mean number of inhabitants per block in Amsterdam is 43 (standard deviation = 40.86) and given the spatial concentration of dwellings of similar price, characteristics, and quality, block-level variables can reasonably proxy for the corresponding household-level information⁴⁵. We also apply neighbourhood fixed effects using four-position-postcode that is comparable to 'zipcode' neighbourhoods in the

⁴³ Schools with less than nine percent students in need of additional weighting were not provided more than per capita funding (Ladd et al., 2010). For the purpose of our chapter we ignore the additional weighting for children of shipping crewmembers or caravan families. From 2006 onwards, all weights were streamlined into two categories based solely on parental education level: 1.20 for students with at least one parent possessing primary-level education only; 0.30 for students with both parents having a maximum of lower vocational-level education.

⁴⁴ Excluding missing postcode information, we do not have neighbourhood information for 2.5 percent of our sample due to new housing after 2004 and sparse neighbourhoods restricted by Statistics Netherlands (defined as having less than 10 residents per six-position-postcode area and 50 residents per four-position-postcode area).

⁴⁵ We have also included average housing value but the variable was more significant at the four-position postcode-level than block-level.

United States with an average number of inhabitants of 12,372 in Amsterdam (standard deviation = 4416.16).

School mobility within the municipality of Amsterdam is observed from the administrative data. It is deemed to have occurred when a student was not registered in the same school location within two consecutive years. From Table 4.3, most native Dutch students (around 71 percent) did not change schools at all and if they did, they did it less frequently (less than 8 percent had changed schools more than once). In contrast, just slightly more than half of the western minority students had not switched schools while the proportion of those who had switched schools more than once almost doubles that of native Dutch students. This is noteworthy considering the fact that more than 90 percent of students across all ethnic backgrounds did not move into a different neighbourhood block (based on six-position postcode area) during that period – see Table 4.4. Hence we can postulate that most of the school mobility observed was due to individual- and school-related factors, and not residential neighbourhood factors.

Table 4.3: Mobility between primary schools in column percentage

School Change	Native Dutch	Moroccan	Antillean-Aruban	Surinam	Turkish	Other Non-west	Western
0	70.95	53.31	50.09	50.63	51.30	55.57	65.32
1	21.47	32.36	30.69	31.58	34.19	31.38	24.80
2	5.45	10.36	12.73	12.20	10.88	9.35	7.06
3	1.49	2.82	4.15	3.84	2.74	2.59	1.87
4 or more	0.64	1.15	2.35	1.75	0.89	1.10	0.95
Total	17,383	9,257	1,108	7,393	5,283	5,742	3,682

Source: Municipality of Amsterdam school data (2000-2008), authors' own calculations. Schools refer to locational-level and limited to those offering standard primary education. We do not have data to correct for 'mobility' due to the merging, division or dissolution of schools.

Table 4.4: Mobility between residential postcodes in column percentage

Postcode Change	Native Dutch	Moroccan	Antillean-Aruban	Surinam	Turkish	Other Non-west	Western
0	96.31	92.83	94.04	91.79	90.74	94.67	95.60
1	3.07	5.92	5.32	6.21	7.22	4.32	3.42
2 or more	0.62	1.25	0.63	2.00	1.82	1.01	0.98
Total	17,383	9,257	1,108	7,393	5,283	5,742	3,682

Source: Municipality of Amsterdam school data (2000-2008), authors' own calculations. Our dataset has approximately 12,477 six-digit postcode areas with an average of 43 inhabitants.

A school's student turnover rate corresponds to its aggregated student mobility between 2000 and 2001 over its student population. From Table 4.3 we know that

non-western students are more likely to change schools compared to native Dutch and western students. And due to ethnic segregation in schools, aggregated student mobility is higher for schools with more non-western students (Pearson's product moment correlation = 0.40, p-value<0.000).

4.4. Empirical strategy and results

Our empirical section seeks to measure the influence of school moving and ethnic school peer effects on early school leaving. In Section 4.4.1, we explore the determinants of one's likelihood to change primary schools frequently. In particular, we correlate school mobility to student's ethnicity and peer ethnicity in school. Next, we explore the detrimental influence of primary school mobility and ethnic segregation on high school dropout in Section 4.4.2. Finally in Section 4.4.3, we examine, using a regression discontinuity design, the influence of a 'contextual tipping point' in school peer composition on early school leaving.

4.4.1. Student mobility in primary schools

We begin by first analysing the ethnic difference in primary school mobility – coded as binary dependent variable for changing schools more than once⁴⁶ – conditional on school peer ethnicity. The probability of moving schools more than once for student i , $P(M_i)$ is estimated using logistic regression as a function of student (including household), primary school, and neighbourhood factors:

$$P(M_i) = \frac{1}{1 - e^{-(\alpha + \beta X_i + \gamma E_i + \rho P_j + \lambda Z_j + \tau T_{-ij} + \varphi E_i * Z_j + \varepsilon_i)}} \quad (4.1)$$

where α is the intercept, E_i is student i 's ethnicity, Z_j is the proportion of non-western students in her primary school j , $E_i * Z_j$ is the interaction between student ethnicity and school peer ethnicity, T_{-ij} is primary school j 's turnover rate excluding student i 's own mobility, and ε_i is the error term. The vectors, X_i , P_j , N_i represent the control variable vectors at the respective student (including student's household), primary school, and neighbourhood-levels.

When we control for neighbourhood fixed effects, our model estimates the conditional logit for the probability of dropping out for student i :

⁴⁶ We choose to restrict our definition of 'movers' to those who have changed schools more than once to isolate the 'at-risk' frequent movers (see Temple and Reynolds, 2000). We assume circumstantial or non-systematic mobility behaviour of students who have only changed schools once, which comprise of approximately a third of non-western minority students and a fifth of native Dutch students (see Table 4.3).

$$P(M_{il}) = \frac{1}{1 - e^{-(\alpha_l + \beta X_{il} + \gamma E_{il} + \rho P_{jl} + \lambda Z_{jl} + \tau T_{-ijl} + \varphi E_{il} * Z_{jl} + \varepsilon_{il})}} \quad (4.2)$$

where α_l denotes the neighbourhood-specific intercept or neighbourhood fixed effect⁴⁷, ε_{il} is the individual- and neighbourhood-specific error term. The variable and vectors – E_{il} , Z_{jl} , T_{-ijl} , X_{il} , and P_{jl} – now become student (including student’s household) and school covariates of within-neighbourhood variability for $P(M_{il})$. By removing the unobserved neighbourhood effects that are common to all neighbourhood residents, we reduce the potential omitted variable bias that may arise from the correlation between neighbourhood effects and our covariates. Since we are interested in the between and within school effect, we do not control for unobserved primary school fixed effects. Nevertheless, we found our results without school fixed effects to be robust.

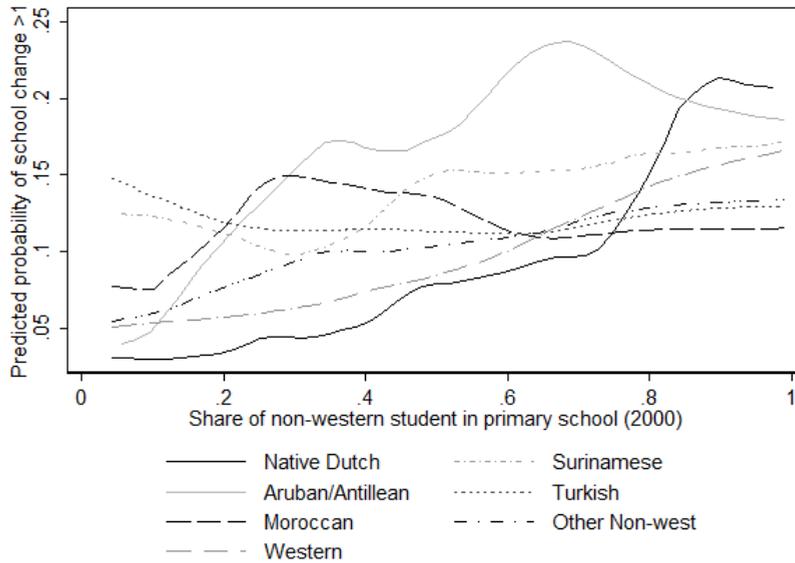
The Amsterdam median category of 40 to 60 percent non-western students in a school is used as a benchmark to distinguish schools with ‘uneven’ ethnic distribution. This operationalisation of ethnic segregation commonly used in segregation studies (see Massey and Denton, 1988) reflects how even or uneven is the distribution of the minority group in a school when compared to the larger areal unit, i.e. the city of Amsterdam. Besides the individual and aggregated school mobility and ethnicity variables reported in Table 4.5, we have controlled for student demographics (gender, age cohort, single-parent household, block-level average income, distance between school and residence) and primary school characteristics (size, educational philosophy or denomination, ethnic composition, share of students with low socioeconomic background). When four-position-postcode neighbourhood fixed effects were not applied, the following neighbourhood variables were included: average housing value, number of inhabitants, and percentages for non-western residents, households with children, welfare recipients, and elderly residents above age 65.

By including the interaction between student ethnicity and school peer ethnicity, $E_{il} * Z_{jl}$, the ethnic difference in likelihood of school mobility is now conditional on school peer ethnicity. To illustrate this interaction effect, we plot the local polynomial graph of the predicted probability of changing schools more than once (based on Model 1 in Table 4.5) by ethnicity, on the percentage of non-western students in Figure 4.1 while holding the other variables at the respective ethnic group’s mean values. Note that the variability exhibited by the Aruban or Dutch Antillean group is due to the small number of observations (863 out of our sample

⁴⁷ Demeaned or ‘within transformation’ fixed effect estimation suppresses the estimation of neighbourhood-specific intercept α_l .

of 41,688 students) hence we should interpret their estimated coefficients and predicted probability with caution.

Figure 4.1: Local polynomial smooth plot of school mobility by ethnicity



Source: Authors' own calculations with combined data from the Municipality of Amsterdam (2000-2008), BRON (2004-2008), MINOCW (2005), and CBS (2004).

The likelihood of frequent school mobility for native Dutch students is much lower than other ethnic groups at low proportions of non-western students but increases exponentially, surpassing that of other ethnic groups if their primary school (in the year 2000) had more than 80 percent non-western students. Their conditional likelihood of changing schools doubles when enrolled in a school with more than 80 percent non-western students, while the reverse is true for students of non-western background as their respective conditional odds decrease by 53 to 73 percent (see Table 4.5: Logistic regression estimates for primary school mobility). With respect to schools with the median ethnic composition, students of non-western (except Dutch Antillean and Aruban) background are between 1.4 to 2.5 times more likely to change primary schools compared to native Dutch students. Surinamese and Turkish minority students are also much more likely – 1.8 and 3.6 times respectively – to change schools when they are enrolled in schools with less than 20 percent non-western students (compared to when they are in schools with 40 to 60 percent non-western minority).

Table 4.5: Logistic regression estimates for primary school mobility

School mobility (1 = moved schools more than once)	Model 1		Model 2	
	Odds ratio	Standard Error	Odds ratio	Standard Error
Individual attributes				
<i>Ethnicity (ref: Native Dutch)</i>				
Surinamese	2.462***	0.318	2.396***	0.327
Antillean/Aruban	1.972**	0.567	1.866*	0.607
Turkish	1.723***	0.319	1.628***	0.276
Moroccan	2.007***	0.486	1.957***	0.284
Other non-western	1.400**	0.212	1.410**	0.224
Western	1.221	0.278	1.229	0.245
Second generation	0.813***	0.046	0.819***	0.044
Primary school attributes				
Turnover rate	1.016**	0.007	1.013***	0.003
<i>% non-western (ref: 40-60%)</i>				
0-20% non-western	0.350***	0.049	0.360***	0.049
20-40% non-western	0.535***	0.083	0.561***	0.066
60-80% non-western	1.394**	0.226	1.406***	0.177
80-100% non-western	3.286***	0.509	3.238***	0.488
Ethnicity*Peer Ethnicity				
Surinamese*0-20% non-west	1.890***	0.456	1.847***	0.423
Surinamese*80-100% non-west	0.356***	0.062	0.379***	0.067
Antillean/Aruban*0-20% non-west	0.727	0.486	0.761	0.515
Antillean/Aruban*80-100% non-west	0.462**	0.150	0.524	0.191
Turkish*0-20% non-west	3.690***	1.425	3.582*	1.302
Turkish*80-100% non-west	0.354***	0.081	0.361***	0.074
Moroccan*0-20% non-west	1.340	0.520	1.288	0.440
Moroccan*80-100% non-west	0.268***	0.071	0.264***	0.048
Other non-west*0-20% non-west	1.384	0.336	1.399	0.363
Other non-west*80-100% non-west	0.468***	0.098	0.474***	0.095
Western*0-20% non-west	1.588*	0.444	1.594*	0.403
Western*80-100% non-west	0.676	0.207	0.658	0.174
Fixed effects	Cohort		Cohort, Neighbourhood	
McFadden pseudo R ²	0.069		0.057	
Total observations	41688		42394	

Note: Two-tailed significance: * p<0.10, ** p<0.05, *** p<0.01. Controlled for gender, age cohort, single-parent, block-level average income, distance to primary school, and primary school characteristics (size, school type, turnover rate, share of students with low socioeconomic status). Without neighbourhood fixed effects, standard errors are clustered at the school-level. To avoid endogeneity, 'turnover rate' here excludes observation's own school change. Interaction terms between 'ethnicity' and intermediate levels of non-western 'peer ethnicity' (i.e. 20-40% and 60-80%) omitted for brevity.

Being of second-generation migrant background (as opposed to first-generation) also has an independent negative influence on school mobility since it reduces the likelihood by 18 percent. There appears to be no significant difference between students of western and native Dutch backgrounds in terms of school mobility behaviour. As expected, since moving residences across postcodes within the city is infrequent, the results are consistent even after controlling for zipcode-level neighbourhood fixed effect. School mobility appears to be due to individual- and school-related factors that are unrelated to residential neighbourhood. We have also tested for three-way interaction effects between ethnicity, second-generation status and peer ethnicity on school mobility but they were found to be insignificant.

4.4.2. Determinants of high school dropout

While the previous section contends the determinants of one's likelihood to change schools frequently, this section explores the detrimental influence of school mobility that is moderated by ethnicity and peer ethnicity. A clear and univocal output indicator is early school leaving. To examine the relationship between ethnicity, school mobility, and early school leaving, we estimate the probability model of high school dropout, $P(Y_i)$ for student i in high school j who was (in the year 2000) enrolled in primary school k and residing in neighbourhood l using binary logistic regression:

$$P(Y_i) = \frac{1}{1 - e^{-(\alpha + \beta X_i + \gamma E_i + \mu M_i + \rho P_j + \lambda Z_j + \tau T_{-ij} + \eta H_k + \nu N_l + \tau E_i * M_i + \varphi E_i * Z_j + \omega E_i * M_i * Z_j + \varepsilon_i)}} \quad (4.3)$$

where E_i is student i 's ethnicity, M_i is her school mobility, Z_j is the proportion of non-western students in her primary school j , and T_{-ij} is primary school j 's turnover rate excluding student i 's own mobility. Two-way and three-way interaction between ethnicity, school mobility, and peer ethnicity are denoted by the terms $E_i * M_i$, $E_i * Z_j$, and $E_i * M_i * Z_j$. The vectors, X_i , P_j , H_k , N_l represent the control variable vectors at the respective student- (including student's household), primary school-, high school-, and neighbourhood-levels. The control variables include: (1) individual covariates: gender, single-parent household, block-level average income, distance to primary school, and high school educational track; (2) primary school covariates: size, educational type, and share of students with low socioeconomic status; (3) high school covariates: size and share of students with migrant background; and (4) neighbourhood covariates: average housing value and share of non-western residents, households with children, welfare recipients, and elderly residents above age 65. Finally, the intercept, α and error term ε_i complete the equation.

Comparing Model 1 and Model 2 in Table 4.6, we see that school mobility has a very strong, positive influence on the likelihood of high school dropout after controlling for student demographics, primary and high school characteristics, and neighbourhood attributes. All things equal, the odds of dropping out of high school for a student who has changed primary schools more than once is approximately 2.6 times the odds of one who was relatively 'school-stable'. Before controlling for interactions between ethnicity, peer ethnicity, and school mobility, students of Moroccan or Turkish background were found to be less likely to drop out of high school when compared to native Dutch students. The predicted conditional odds of high school dropout decrease by 35 percent for students of Moroccan and Turkish background when compared to native Dutch students.

However, once the two- and three-way interaction terms were included (see Model 3 and Model 4 in Table 4.6), the ethnic difference in the propensity to drop out of high school becomes conditional to primary school ethnic composition and school mobility. In schools with a median non-western composition of 40 to 60 percent (our reference category), there is no statistically significant difference between native Dutch students and those of a foreign background, regardless of their school mobility. In contrast, for a native Dutch student who is 'school stable', being in the school with more than 80 percent non-western students (instead of an ethnically mixed school) increases the odds of dropout by a factor of 1.7. The three-way interaction terms between ethnicity, peer ethnicity, and school mobility were individually statistically insignificant at the five percent level (except for 'frequent movers' of Moroccan background in schools with 60 to 80 percent non-western students) although collectively they are statistically significant (Wald $\chi^2 = 50.291$, p-value < 0.000)⁴⁸.

⁴⁸ There are only slight differences in the results when three-way interaction terms were included – full empirical results can be obtained upon request. We have additionally controlled for neighbourhood fixed effects (which did not alter the results substantially) and tested for three-way interaction between second-generation status, ethnicity, and peer ethnicity, and four-way interaction between second-generation status, ethnicity, peer ethnicity and school change. These interaction results were not robust (with oversized logit coefficients) due to sparse cells.

Table 4.6: Logistic regression estimates for high school dropout

Dropout	Odds Ratio	Odds Ratio	Odds Ratio	Odds Ratio
<i>Ethnicity (ref: Native Dutch)</i>				
Surinamese	0.948 (0.083)	0.870 (0.077)	0.905 (0.091)	0.860 (0.171)
Antillean/Aruban	1.371*** (0.149)	1.237* (0.132)	1.209 (0.156)	1.319 (0.592)
Turkish	0.669*** (0.064)	0.652*** (0.062)	0.716*** (0.071)	0.757 (0.138)
Moroccan	0.671*** (0.069)	0.651*** (0.065)	0.689*** (0.078)	0.559* (0.168)
Other non-western	1.043 (0.099)	0.997 (0.096)	1.084 (0.118)	1.220 (0.247)
Western	1.254** (0.127)	1.207* (0.123)	1.212* (0.139)	1.456 (0.346)
Moved schools >1		2.642*** (0.139)	3.225*** (0.326)	2.596*** (0.676)
Surinamese*Mobility			0.842 (0.119)	1.584 (0.704)
Antillean/Aruban* Mobility			1.014 (0.247)	0.825 (0.581)
Turkish*Mobility			0.636** (0.118)	1.278 (0.457)
Moroccan*Mobility			0.793 (0.137)	2.085 (0.934)
Other non-western* Mobility			0.647** (0.118)	0.734 (0.360)
Western*Mobility			0.976 (0.222)	0.949 (0.564)
Primary school characteristics				
<i>% non-western (ref: 40-60%)</i>				
0-40% non-western			0.971 (0.079)	1.038 (0.139)
60-80% non-western			0.857** (0.065)	0.689** (0.109)
80-100% non-western			0.908 (0.090)	1.738*** (0.334)
3-way Interaction	No	No	No	Yes
Fixed effects	Cohort, Track	Cohort, Track	Cohort, Track	Cohort, Track
McFadden pseudo R ²	0.141	0.157	0.157	0.161
Total observations	41743	41743	41295	41295

Note: Two-tailed significance: * p<0.10, ** p<0.05, *** p<0.01. Standard errors in parentheses clustered at primary school-level. Three-way interaction involves ethnicity, school mobility, and peers ethnicity. Covariates: (1) individual: gender, second-generation migrant, single-parent, average income, distance to primary school, high school educational track; (2) primary school: size, type, turnover rate, share of low socioeconomic peers; (3) high school: size, share of migrant peers ; (4) neighbourhood: mean housing value, and share of non-western, households with children, welfare recipients, and elderly.

Based on our last model, we estimate the predicted probabilities of high school dropout for the different ethnic, peer ethnic composition, and school mobility groups in Table 4.7 while holding the other variables at their respective subgroup (conditional on ethnicity, peer ethnicity, and school mobility) mean values. For a relatively rare event of high school dropout, these within-group marginal effects could be more intuitive to interpret than the multiplicative effects from the previous table (Buis, 2010).

Table 4.7: Predicted probabilities of high school dropout

Ethnicity	School change once or less				School change more than once			
	Percentage non-western residents in primary school							
	0-40%	40-60%	60-80%	>80%	0-40%	40-60%	60-80%	>80%
Native Dutch	0.032	0.039	0.037	0.111	0.165	0.143	0.220	0.186
Surinamese	0.031	0.044	0.045	0.068	0.111	0.181	0.201	0.167
Aruban/Antillean	0.042	0.070	0.045	0.096	0.174	0.215	0.187	0.274
Turkish	0.021	0.042	0.043	0.045	0.162	0.153	0.128	0.067
Morocco	0.045	0.030	0.043	0.041	0.148	0.207	0.091	0.118
Other non-western	0.040	0.050	0.041	0.052	0.082	0.143	0.118	0.147
Western	0.038	0.057	0.049	0.043	0.205	0.204	0.129	0.155

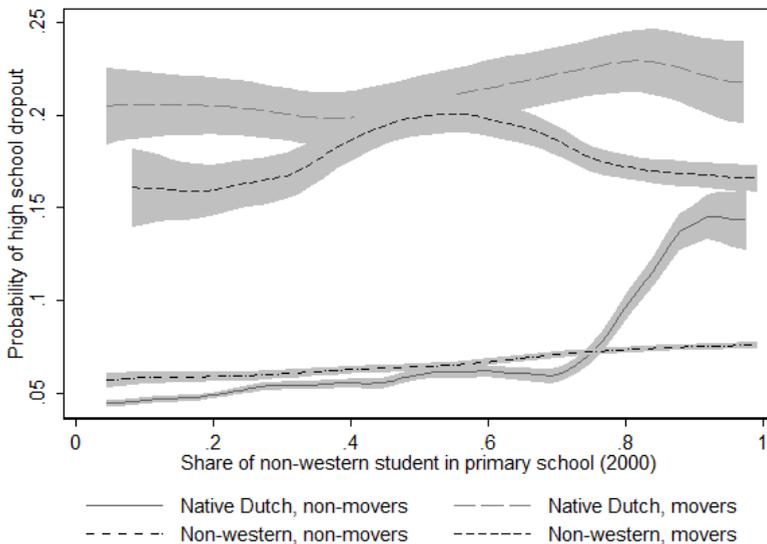
Note: Results based on model with three-way interaction between ethnicity, peer ethnicity and school mobility.

The interaction effect between school mobility, ethnicity and peer ethnicity is clear. The likelihood of high school dropout for Native Dutch students is highest for frequent school movers with above median proportion of non-western students. Almost one fifth of these Native Dutch students are predicted to drop out of high school. Meanwhile the probability of early school leaving for ‘school stable’ students of Turkish and Moroccan background is predicted to be between 2 and 4.5 percent, substantially below the unconditional sample average dropout rate of 7.6 percent. Surinamese ‘school stable’ students have slightly higher predicted probabilities between 3.1 and 6.8 percent. Due to the small sample size of students with Aruban or Dutch Antillean background, their relevant probabilities should be interpreted with caution.

Being in a ‘black school’ is most adversely associated with native Dutch ‘school-stable’ students compared to students of other ethnicity (except those of Dutch Antillean and Aruban background). So much so, for primary schools with more than 80 percent non-western students, even ‘mover’ students of Turkish background have lower predicted probability of dropout than ‘non-mover’ Native Dutch students. The local polynomial smooth plot in Figure 4.2 depicts how the predicted probability of dropout (calculated in Table 4.7 based on Model 4) for

‘school-stable’ native Dutch students increases exponentially after a certain share of non-western peers. This surpasses the predicted dropout probability of ‘school stable’ non-western minority students which varies slightly across school ethnic composition. Besides the potential bias of specific native Dutch students self-selecting themselves into ‘black schools’, it is plausible that members of the ethnic majority group do not adapt well when they are in role of the minority. Nonetheless, due to omitted variable biases, such as self-selection and from the lack of parental background information, we cannot establish the causal effects of our explanatory variables on early school leaving. Hence, in the following subsection, we attempt to establish causal effect of peer ethnicity by deducing a ‘contextual tipping point’ and estimating its potential discontinuous effect on the probability of school dropout.

Figure 4.2: Local polynomial smooth plot for probability of high school dropout



Source: Authors’ own calculations with combined data from the Municipality of Amsterdam (2000-2008), BRON (2004-2008), MINOCW (2005), and CBS (2004). ‘Movers’ refer to those who have changed schools more than once. The shaded grey area corresponds to the 95 percent confidence interval with standard errors clustered at the primary school-level.

4.4.3. Causal evidence by a contextual tipping point

Visual inspection of Figure 4.2 suggests a potential ‘contextual tipping point’ effect of share of non-western peers on the dropout probability of non-mover native Dutch students. This group makes up approximately a third of our sample, i.e. the largest subgroup. Besides the evidently different dynamics affecting ‘movers’ and ‘non-movers’, focusing on ‘non-movers’ permits us to reduce the effect of ‘at-risk’

students. In this section, we use high-order polynomial regression and a regression discontinuity design to deduce and statistically test the ‘contextual tipping point’ effect of non-western student composition on Dutch ‘non-mover’ students.

Selection of the tipping point

To appropriately fit a global polynomial model, we select only native Dutch ‘non-movers’ who were enrolled in primary schools with a majority of non-western students in year 2000, $Z_j > 0.5$. From there, two random samples for mutually independent tipping point search procedure and hypothesis test are created (c.f. “fixed point” search procedure employed in Card et al., 2008a). We first fit the deviation of the conditional predicted probability of school dropout (from our last model) from the sample mean, $\hat{P}(Y_i) - \bar{x}_{P(Y)}$, to a quartic polynomial in share of non-western students in primary school, Z_j with ε_i representing the error term⁴⁹:

$$\hat{P}(Y_i) - \bar{x}_{P(Y)} = \sum_{p=0}^4 \lambda_p Z_j^p + \varepsilon_i \quad (4.4)$$

Based on visual inspection and our analyses so far, we expect the predicted probability of dropout to be lower than the sample average at low percentages of non-western peers until it reaches the tipping point, after which, the positive slope becomes disproportionately steep. If the equation has at least one real root, we expect the function to cross the average dropout probability from below, i.e. with a positive slope, at one of the roots. The regression coefficients are used to calculate the roots of the polynomial equation and we choose the root ($x = 0.76013$) which provides the most positive slope as a potential ‘contextual tipping point’. We refine the search procedure by estimating a cubic polynomial using a smaller sample within 10 percentage points from the previously identified root and selecting the polynomial root with the most positive slope – share of non-western students equals 0.77688 – as the final ‘contextual tipping point’.

The regression discontinuity design

For the random sample of the students not selected for the tipping point procedure, we estimate the local difference in conditional predicted probability of school dropout at ‘contextual tipping point’ and test the potential discontinuity effect with regression discontinuity method based on the empirical specification below:

⁴⁹ Adapting the polynomial regression model by Card et al. (2008a) with both dependent and independent variables derived from one continuous variable, we use the predicted probability of our binary event (school dropout) from our last regression model, $\hat{P}(Y_i)$ as the dependent variable. Since the logit estimation of the binary event with polynomials and control variables did not converge, this alternative using predicted values allows for the probability of dropout to be conditional to other explanatory variables and for the global, quartic polynomial fit on share of non-western students.

$$P(Y_i) = \frac{1}{1 - e^{-(\alpha + \beta X_i + \rho P_j + \pi(Z_j - Z_{tip}) + d\mathbf{1}[Z_j > 0] + \tau T_{-ij} + \eta \mathbf{H}_k + \nu \mathbf{N}_l + \varepsilon_i)}} \quad (4.5)$$

where, as before, α is the intercept, T_{-ij} is primary school j 's turnover rate excluding student i 's own mobility, ε_i is error term while the vectors, \mathbf{X}_i , \mathbf{P}_j , \mathbf{H}_k , \mathbf{N}_l represent the control variable vectors at the respective student- (including student's household), primary school-, high school-, and neighbourhood-levels. The new variable, $d\mathbf{1}[Z_j > 0]$ is an indicator variable taking the value one if the proportion of non-western students is larger than the 'tipping point' share, Z_{tip} , and zero otherwise. The proportion of non-western students in primary school is then measured as the deviation from this tipping point, $(Z_j - Z_{tip})$.

Results

Among 'non-mover' native Dutch students, the conditional probability of school dropout for one enrolled in primary schools beyond the 'contextual tipping point' of 77.7 percent is 8.4 times (derived from $e^{2.127}$) the odds of another enrolled in a primary school with proportionally less non-western students (see Table 4.8). This difference in conditional probability is statistically significant, suggesting discontinuity in the effect of non-western peers on early school leaving, as is evident in Figure 4.3. The mean conditional difference in predicted probability of school dropout between students on different sides of the tipping point is 5.4 percent. The discontinuity point is robust to using only local observations, i.e. those located at 10 percentage-points before and after the 'contextual tipping point' as seen in the last model of Table 4.8. For sensitivity analysis, we have also smoothed the probability of school dropout as a polynomial function of $(Z_j - Z_{tip})$ and found the discontinuity indicator to be statistically significant at the five percent level (with third-order polynomials) and at the ten percent level (with second- and fourth-order polynomials). For ease of exposition here, we choose the linear function on share of non-western students minus the 'contextual tipping point' value.

If the 'contextual tipping point' identified from our data is not observed by parents, we can assume that it is exogenous and provides support for the causal effect of peer ethnicity in primary school on early school leaving for these 'non-mover' native Dutch students. For the small number of observations located just before and after the 'contextual tipping point' ($N = 141$), there is statistically significant discontinuity effect⁵⁰. Those who are within 10 percentage points

⁵⁰ We have further tested the sensitivity of this interval width since there could still be significant differences between students within this 67 percent to 87 percent non-western school peer sample that could affect dropout probability, hence violating our regression discontinuity assumptions (Van der

beyond the 'contextual tipping point' have on average 5.9 percent higher conditional predicted probability of school dropout than those who are within 10 percentage points before the threshold. Despite having trimmed 80 percent of the outermost data points, the size of peer ethnicity effect is now only slightly larger than the effect estimated using the test sample (N = 726) of native Dutch 'non-movers' in schools with a majority of non-western peers.

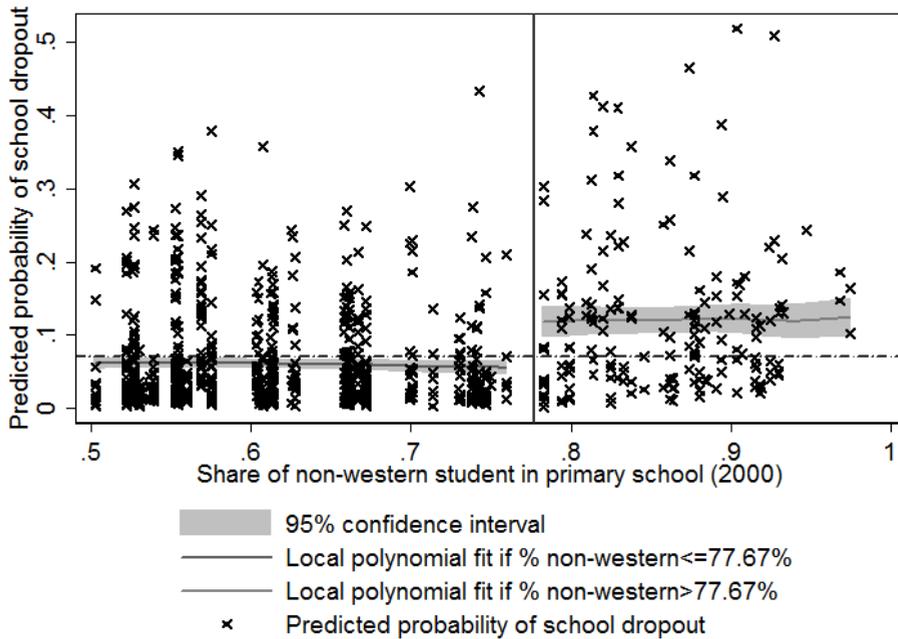
Table 4.8: Logit estimates of the 'contextual tipping point' effect

School Dropout	(1)	(2)	(3)	(4)	(5)
Beyond tipping point (> 0.77668)	2.13*** (0.74)	4.91* (4.62)	2.64** (1.34)	2.46* (1.45)	3.95*** (1.35)
Linear in share of non-western peers minus CTP	y				y
Quadratic in share of non-western peers minus CTP		y			
Cubic in share of non-western peers minus CTP			y		
Quartic in share of non-western peers minus CTP				y	
Threshold sample: 67%-87% non-western peers					y
Demographic/School/Neighbourhood controls	y	y	y	y	y
McFadden's pseudo R-square	0.261	0.270	0.275	0.275	0.424
Number of observations	726	726	726	726	141

Note: Two-tailed significance: * p<0.10, ** p<0.05, *** p<0.01. Standard errors in parentheses clustered at the primary school level. Sample only includes the remaining one-third of Dutch non-movers not used in the tipping point search procedure. Covariates: (1) individual: gender, second-generation migrant, single-parent, average income, distance to primary school, high school educational track; (2) primary school: size, type, turnover rate, share of low socioeconomic peers; (3) high school: size, share of migrant peers; (4) neighbourhood: mean housing value, and share of non-western, households with children, welfare recipients, and elderly.

Klaauw, 2008, 2002). While the results remain statistically significant, the logit coefficients in the smaller sample interval are oversized indicating sparse data points (e.g. only 61 observations between 68 to 86 percent non-western students).

Figure 4.3: Predicted probability of dropout for native Dutch 'non-movers'



Source: Authors' own calculations with combined data from the Municipality of Amsterdam (2000-2008), BRON (2004-2008), MINOCW (2005), and CBS (2004). The discontinuity point of high school dropout probability at 77.7 percent of non-western student in primary school is found to be statistically significant at the one percent level with standard errors clustered at the school-level. The dash horizontal line represents the sample mean dropout rate.

As an additional robustness check, we have explored the possibility that the relationship between peer ethnicity and early school leaving is driven by school quality by looking into education inspectorate assessments in 2012⁵¹. Only 4 out of the 56 schools with more than 77 percent non-western students in our sample have been evaluated as a 'weak school' based on the school's educational performance, learning process and financial management (Inspectie van het Onderwijs, 2009b). None were evaluated as 'very weak schools'. Unsurprisingly, controlling for school quality did not affect our results⁵².

⁵¹ Data can be assess via the education inspectorate website, <http://www.onderwijsinspectie.nl>. Unfortunately we do not have earlier inspectorate assessments. We would assume that the school quality did not differ significantly over the years.

⁵² Results with school quality control are available upon request.

4.5. Conclusion and policy implications

This chapter examined the effect of ethnic segregation and school mobility in primary education on high school dropout. Our rich administrative data – with various control variables on the student, household, school, and neighbourhood-levels – and with links between primary school information and high school outcomes reduce the problem of endogeneity caused by measurement error, simultaneity, and omitted variable bias. We have taken a step further in this chapter to estimate a ‘contextual tipping point’ effect of non-western peers on ‘school stable’ native Dutch students in order to verify potential causality between ethnic peer effects and school dropout.

The first main lesson from our study is that there are long-term effects of primary school conditions and student behaviour – in this case, on high school dropout as the outcome. Our results reveal that frequent school movers during primary schooling have a 2.6 times higher likelihood of dropping out from high school after controlling for various individual, school, and neighbourhood characteristics.

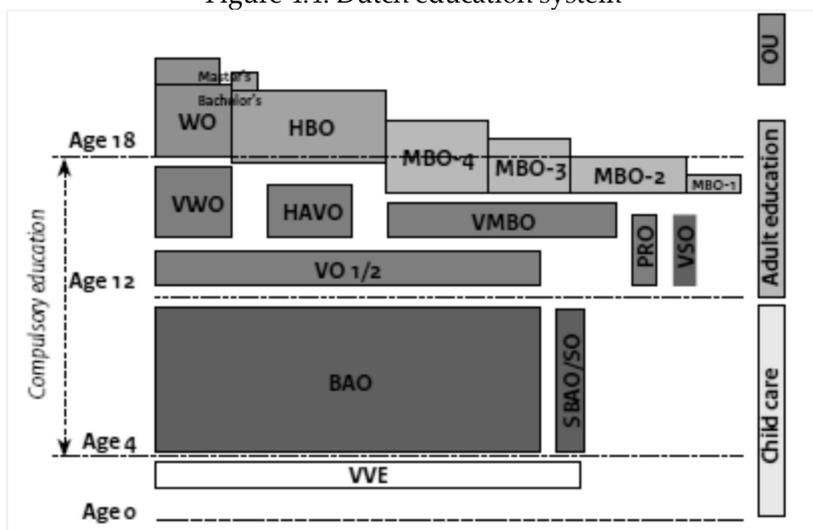
The second lesson is that, depending on the student’s own ethnicity and mobility status, there is some influence of non-western peers on early school leaving. Diverging from findings of the insignificant effect of migrant student peers on native ethnic students (e.g. Ohinata and Ours, 2011 for the Netherlands), we find that native Dutch ‘non-mover’ students in primary schools with more than 80 percent non-western students (instead of an ethnically mixed school) have 1.7 times higher odds of dropout. This could, among others, be due to definitional difference on the concept of ‘peers’ as we measure ethnic composition at the school-level, and the fact that we have controlled for school mobility. The latter isolates the potentially ‘at-risk’ students who experience different underlying forces in their school behaviour and outcomes.

We extended our analysis for the native Dutch ‘non-mover’ subgroup by extracting two independent samples: (1) to identify a ‘contextual tipping point’ of the share of non-western peers using a polynomial regression and (2) to test the tipping point effect using a regression discontinuity method. The conditional predicted probability of school dropout increases by 5.4 percent points to 8.0 percent if students are enrolled in primary schools with more than 77.7 percent non-western minority students. This peer effect on school dropout is statistically significant and is assumed to be causal since parents and students do not observe this ‘contextual tipping point’ and do not self-select into schools at either side of the threshold within a narrow interval.

Yet, we refrain from extrapolating the '77.7 percent' contextual tipping point to the rest of The Netherlands since our sample is limited to the ethnically diverse municipality of Amsterdam. The complex interrelationship between ethnic peer effect, student ethnicity, school mobility, and early school leaving as uncovered in this chapter mandates further research with a richer set of control variables and a wider sample to account for city and country effects. Further quantitative research could include more detailed information on parental background and individual student ability, which are lacking in the current study. Qualitative research could also enrich this research niche by looking at the processes underlying these peer contextual effects.

4.6. Appendix

Figure 4.4: Dutch education system



Note: BAO = mainstream primary education, BBL = block or day release in vocational education, BOL = full-time vocational programmes, HAVO = general secondary education, HBO = professional higher education, MBO = vocational education, OU = Open University, PRO = elementary vocational training, SBAO = special primary education, SO = special education, VMBO = pre-vocational secondary education, VO = secondary education, VSO = secondary special education, VVE = early childhood education, VWO = pre-university education, WO = academic higher education.

Source: Ministerie van Onderwijs Cultuur en Wetenschap (2012)

5. Dynamics of neighbourhood composition⁵³

5.1. Introduction

Preferences for housing, neighbourhoods, and schools explored in Chapters 2 and 3 only partially explain segregation outcomes. Nonlinear dynamic of school or neighbourhood composition over time bridges individual household preferences with the aggregated segregation outcomes. This chapter zooms out of preferences to examine neighbourhood dynamics. More specifically, it uses a similar methodology from Chapter 4 combining high-order polynomial regression and a regression discontinuity design to test the existence of neighbourhood ‘tipping points’ (c.f. Card et al., 2008a).

Schelling (1971, p. 181) characterises the neighbourhood ‘tipping point’ as the point where ‘*a recognisable new minority enters a neighbourhood in sufficient numbers to cause the earlier residents to begin evacuating*’. The related literature defines this phenomenon as ‘white flight’ (Boustan, 2010; see also Coleman et al., 1975; first mentioned in Grodzins, 1958). Despite its origin in North American racial segregation literature, ‘white flight’ research is picking up in Western Europe with its rising migrant population (Mocetti and Porello, 2010; Rathelot and Safi, 2013).

Empirically, the Schelling ‘all-minority’ neighbourhood is rarely observed even in the United States and more so in the Netherlands with its lower levels of socioeconomic and spatial inequalities (Musterd, 2005). To begin with, not all native population consider minority neighbours to be a disamenity. Next, neighbourhood ethnic composition is but one of many factors that determines residential location choice. Besides other neighbourhood attributes, one needs to account for the neighbourhood supply of dwelling types because housing is a heterogeneous good that is made up of many attributes such as central heating and the number of rooms (c.f. Bajari and Kahn, 2005). This multidimensionality to neighbourhood valuation allows for semi-stable ‘integrated’ neighbourhoods with share of minority below the tipping point (we refer to the difference between “one-sided” and “two-sided” tipping in Card et al., 2008b).

But why should we care about white flight and neighbourhood tipping points? The significance of neighbourhood tipping point research is tied to its sister literature

⁵³ This chapter is based on the paper: Ong, Cheng Boon. (2014). “Tipping points? Ethnic composition change in Dutch big city neighbourhoods.” *UNU-MERIT Working Paper Series* (2014-011).

on segregated neighbourhood effects. Social interaction-based models tackling 'peer' influences on individual behaviour have been used to study a variety of topics, from education (Overman, 2002), teenage pregnancy (Crane, 1991), to crime (Kling et al., 2005). If neighbourhood peer effects do exist, segregated neighbourhoods could foster the intergenerational transmission of social inequality (Borjas, 1995). For brevity, this chapter refers to the extensive reviews by Jenks and Mayer (1990), Sampson et al. (2002) and Durlauf (2004). Despite vacillating empirical results on neighbourhood effects on a specific social outcome, residential segregation with respect to an immigrant minority group is still an indicator of social exclusion and cohesion in the host society (Logan et al., 2002; Massey, 1981). Tipping point research hence, offers a dynamic perspective to neighbourhood ethnic composition and explores the possibility of cultivating 'integrated' or 'mixed' neighbourhoods instead.

Card and colleagues' 'tipping point' study claims to '*provide some of the first direct evidence of the non-linear dynamic behaviour predicted by social interaction models*' (2008a, p. 212). The 'tipping point' hypothesis was tested for various metropolitan areas using the American census tract data from 1970 to 2000 and regression discontinuity method. The contribution of this chapter applying Card et al.'s neighbourhood tipping point framework to a country like the Netherlands is three-fold. First, unlike the segregation discourse in the United States – a traditional immigrant country complicated by a slavery history – ethnic segregation in Western Europe revolves around a native majority group and a voluntary immigrant group received in the last few decades. The majority of the 'non-western' immigrants received in the 1960s and 1970s were low-skilled 'guest-workers'. The 'non-western' definition also precludes ethnic groups deemed to be well assimilated (i.e. Japanese and Indonesian) thus underscoring the socioeconomic dimension in the Dutch ethnic segregation discourse. Since then, the 'non-western' minority population in the Netherlands has increased by a factor of 12 from 162,320 in 1972 to almost 2 million in 2013 (CBS 2014). A considerable number compared to the national population of only 16.8 million and with most of the 'non-western' group concentrated in the four largest cities.

Micro-level studies in the Netherlands using individual and household data have shown that residential location choices are affected by neighbourhood ethnic composition (Bolt et al., 2008; van der Laan Bouma-Doff, 2007; van Ham and Feijten, 2008; Zorlu and Latten, 2009; Zorlu and Mulder, 2008). In the Dutch context, 'white flight' generally refers to the spatial residential mobility of native Dutch and western-origin households who have relatively more resources than non-western minority households in the housing market (Musterd and Deurloo, 2002; Musterd and De Vos, 2007). This corresponds to the negative relationship between non-western minority neighbourhood composition and housing price

with the distaste for non-western minority neighbours also exhibited by some of the non-western minority homeowners (see Chapter 2). Bolt et al. (2008) found native Dutch households to be more likely, compared to non-western minority households, to move out of 'concentrated' neighbourhoods with at least 40 percent non-western minority. There is also evidence of 'white avoidance' (Ellen, 2000) with native Dutch households being less likely, compared to Turkish and Moroccan households, to move from a 'non-concentrated' to a 'concentrated' non-western neighbourhood (Bolt et al., 2008). While the occurrence of 'white flight' and 'white avoidance' has been heavily implied in the abovementioned Dutch studies, none (to my best knowledge) has focused on finding potential critical thresholds in ethnic minority composition beyond which neighbourhoods will tip. This chapter aims to fill this scholarly gap.

As a second contribution, this chapter offers an interesting comparison between a West European investigation and the North American findings prevalent in the neighbourhood segregation literature. The centralised tax regime, large social housing sector, and pervasive regulatory role of the government in the Netherlands are expected to moderate neighbourhood segregation outcomes. As a densely populated country, the state is mandated to heavily regulate housing and land markets with subsidies (e.g. for the construction of social housing), zoning and land use plan, and legislations such as the Housing Act (Dieleman et al., 1999). Strong central governance and redistribution offer a levelling effect across neighbourhoods and municipalities to reduce 'Tiebout-type' of neighbourhood sorting (Tiebout, 1956). Inevitably, Vermeulen and Rouwendal (2007) find housing supply in the Netherlands to be inelastic to prices.

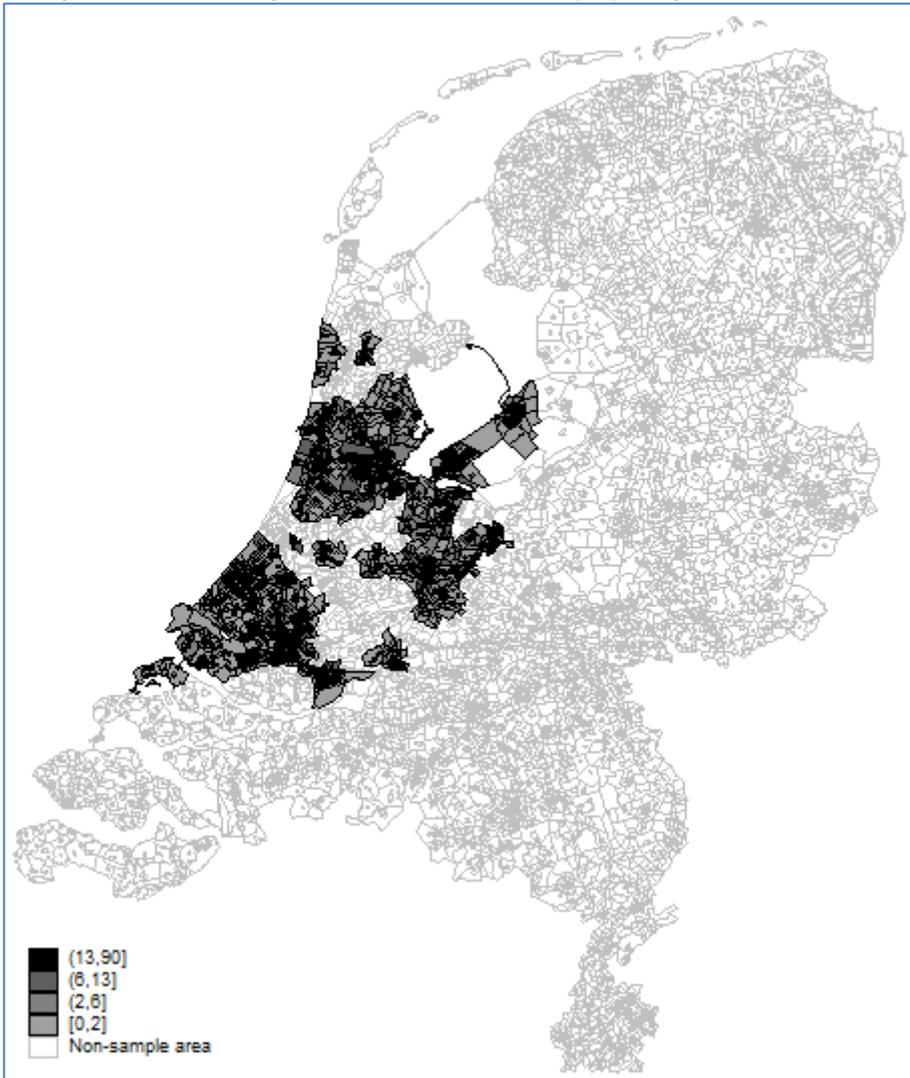
Third, during the study's observation period, neighbourhood ethnic and socioeconomic composition has been tempered by urban restructuring policies with explicit aims for selective out-migration from neighbourhoods and 'social mixing'. 'Social mixing' here refers to the desegregation of social groups stratified based on socioeconomic and demographic characteristics in the targeted spatial set. It was the main message in policy documents such as 'The Differentiated City' and the 'Report on Urban Renewal' and the centrally coordinated policies such as the 'Big City Policies' in the 1990s and the more recent 'Priority Neighbourhoods' policy (Ministerie van VROM 1996, 1997, 2007a; VROM-raad, 2001; Tweede Kamer, 1990). The earlier policies were more structural, e.g. through the sale of social rented dwellings, demolition and replacement, upgrading, and joining with other units (Kruijthoff, 2003). The later 'Vogelaar' or 'Priority Neighbourhoods' (*Aandachtwijken*) policy from 2007 was more social-oriented with large investments made in other key areas such as schooling (Ministerie van VROM 2007a; Permentier et al., 2013).

Ethnic-based desegregation was never an explicit policy aim although the conflation of the 'non-western' and socioeconomic status has provided a convenient pretext. Policymakers were concerned by both the socioeconomic and ethnic segregation especially in relation to the assimilation of those of migrant background. On the one hand, the lack of 'tipping point' dynamic to neighbourhood ethnic and socioeconomic change could validate the relevant policies. On the other hand, if it exists, identifying 'tipping points' could help distinguish 'remedial' and 'preventive' target neighbourhoods for area-based policymaking (Galster et al., 2000). A dynamic outlook improves on the current use of static indicators used to select 'problem' neighbourhoods in the Netherlands – also pointed out by Van Gent and colleagues (2009) in their critique of the 'Priority Neighbourhoods' urban restructuring programme.

This chapter examines neighbourhood dynamics in three main conurbations in the Netherlands: (i) the Amsterdam metropolitan region, (ii) the Rotterdam-The Hague metropolitan region, and (iii) the 'Randstad' urban agglomeration, the country's largest which overlaps to a large extent with the first two metropolitan areas. The concentration of non-western minority inhabitants in the neighbourhoods included in this study is presented in Figure 5.1.

In the following sections, the study's data and methodology (Sections 5.2 and 5.3) along with its empirical findings (Section 5.4) are outlined, before the discussion on why neighbourhood ethnic composition in Dutch big cities did not exhibit 'tipping point' behaviour between 1998 and 2008 (Section 5.5). A final section then concludes.

Figure 5.1: Percentage of non-western minority by neighbourhood, 2009



Source: CBS (2013c, 2010c). 'Neighbourhood' here refers to the administrative definition '*buurt*' while the remainder of the chapter denotes the four-digit postcode area.

5.2. Data

To determine the existence of tipping behaviour in neighbourhood ethnic composition in the Netherlands, the estimation methodology proposed by Card, Mas, and Rothstein (2008a, 2006) is applied to Dutch neighbourhood panel data from 1998 to 2008 (2013c see Appendix for further elaboration of the dataset, CBS 2010d). For detailed explanation on the estimation methodology and its underlying theoretical framework, refer to the abovementioned papers. Due to the

relatively small spatial and population size of Dutch cities⁵⁴ and the data-intensive methods proposed by Card et al., the study focuses on the 'Randstad' or the largest urban agglomeration in the Netherlands which consists of four provinces: Noord-Holland, Zuid-Holland, Flevoland, and Utrecht (further information on the Randstad available in Hendriks, 2006). In addition, smaller sample analyses were conducted for two metropolitan regions: the Amsterdam metropolitan area and the Rotterdam-The Hague metropolitan area. In 2009, approximately 2.3 million inhabitants live in the Amsterdam metropolitan area spread across 1,604 square kilometres of land while a similar number – 2.2 million – live in the smaller Rotterdam-The Hague metropolitan area of 993 square kilometres (see Table 5.1). The Randstad area also overlaps, but not entirely, the two metropolitan regions with its 2,702 square kilometres of land mass and 5.2 million inhabitants, almost a third of the national population.

Relevant neighbourhood data from Statistics Netherlands (CBS) are only available from 1998, unlike the three decade-span American Census data used by Card et al. (2008a). Noticeable change in neighbourhood attributes such as ethnic composition would rely on the mobility of many disaggregated households and thus, is expected to be gradual. So, despite the annual Dutch neighbourhood data, only the data from years 1998 and 2008 are utilised to compute decadal net growth rate in neighbourhood share of native Dutch and western minority – the main dependent variable. Using decadal neighbourhood ethnic turnover as opposed to a pure 'white flight' measure is advantageous as it incorporates 'white avoidance', i.e. 'white' households avoiding neighbourhoods with 'non-white' proportions beyond the critical threshold when relocating (Ellen, 2000).

As neighbourhood units, the Dutch four-digit postcode area is used since it is comparable to the census tract in the United States. The average number of inhabitants per four-digit postcode neighbourhood is 4,282 at the country-level and 7,199 at the big city-level in 2009 (see Table 5.1). The size of a four-digit postcode area in the Randstad is about 3.7 square kilometres (1.4 square miles). Similar information is available at a smaller spatial aggregation-level, i.e. the more homogenous and functionally demarcated 'buurt', but the four-digit-postcode neighbourhood is more stable over time and appropriate for our study. As a result, ethnic composition change is observed for more than 98 percent of the four-digit postcode neighbourhoods between 1998 and 2008. Following Card et al. (2008a), sparse neighbourhoods with less than fifty inhabitants were excluded in the later analysis along with neighbourhoods with population growth rates that are larger

⁵⁴ For example, there are only 69 and 59 four-digit-postcode neighbourhoods within the Amsterdam and The Hague municipalities respectively, while Card et al. excluded cities with fewer than 100 census tracts (2008a).

than 1000 percent or native Dutch population growth rates that are higher than 500 percent during this period⁵⁵.

The Dutch statistical data categorise one as of 'foreign' background by her country of birth or that of (one of) her parents for second-generation migrants. 'Non-western' refers to origins from Turkey, Africa, Latin America, the Caribbean, and Asia, with the notable exceptions of Indonesia and Japan. Inhabitants with origins from the latter two are considered 'western' due to their perceived assimilation with the host country. The conflation of socioeconomic assimilation and ethnicity leads this study to primarily group the 'western' minority with the native Dutch as part of the dependent variable (although this assumption is relaxed to check for the robustness of the results).

From Table 5.1, it is evident that neighbourhoods in the conurbations have a much higher percentage of western and non-western minority residents compared to the rest of the country. This is despite the underestimation of average postcode neighbourhood share of non-western minority provided in Table 5.1 as its corresponding information is not provided in the administrative neighbourhood data for neighbourhoods with fewer than 10 non-western minority residents (CBS 2013d)⁵⁶. Comparatively, these neighbourhoods are on average, also wealthier, more expensive and densely populated, and have proportionally less homeowners and more single-person households.

⁵⁵ Card et al. (2008a) excluded census tracts with growth rates larger than five standard deviations of the metropolitan statistical area average and/or have experienced growth of native 'white' population that is more than 500 percent of the base population.

⁵⁶ Native Dutch share in Table 5.1 is overestimated as it is calculated based on the neighbourhood western and non-western minority composition.

Table 5.1: Descriptive statistics of regional and neighbourhood attributes, 2009

	The Netherlands	Randstad	Amsterdam Metropolitan	Rotterdam-The Hague
Land size (km ²)	33681.0	2702.9	1604.3	992.9
Total residents ('000)	16500.0	5197.8	2267.3	2196.5
Total households ('000)	7317.8	2464.6	1079.4	1034.9
<u>Neighbourhood attributes</u>				
Land size (km ²)	8.7	3.7	4.8	3.4
Number of residents	4282.2	7199.1	6788.3	7471.2
Number of households	1900.2	3413.5	3231.7	3520.1
Native Dutch (%)	86.8	73.4	75.4	70.0
Western (%)	7.4	10.5	10.6	10.8
Non-western (%)	5.8	16.1	14.0	19.2
Turkish (%)	1.6	3.2	2.5	3.8
Moroccan (%)	1.4	3.3	2.9	3.0
Surinamese (%)	1.4	3.9	3.7	5.0
Antillean/Aruban (%)	0.6	1.4	1.0	1.9
Other non-western (%)	3.3	5.6	5.4	6.4
Single household (%)	28.1	37.9	36.3	38.0
HH with kids (%)	39.2	33.7	34.5	33.4
Mean household size	2.4	2.2	2.2	2.2
Average income ('000)	29.6	32.5	33.7	32.2
Welfare recipients (%)	18.7	20.9	20.5	21.2
HH below social minimum (%)	6.8	8.5	8.0	9.4
Owner-occupied (%)	68.8	53.3	55.4	51.8
Rental (%)	30.3	45.3	43.2	47.0
Dwelling price ('000)	282.7	279.7	313.5	247.3
Residential density	4.0	2.5	2.9	2.2
Total neighbourhoods*	3941	745	346	305

Source: CBS (2013c). *Maximum number of four-digit postcode neighbourhoods which does not exclude neighbourhoods with missing values on the covariates. 'HH' refers to households and average income is per income-earner. 'Ethnicity' variables refer to country of birth or, for second-generation migrants, the mother's country-of-birth that is considered primarily to that of the father's. 'Residential density' is measured from very high (1) to very low (5). '% Welfare recipients' measures the share of inhabitants aged 15 to 64 who reported receiving pension, unemployment, disability, or other welfare benefit as their main source of income in 1998.

5.3. Methodology

The Card et al. (2008a, 2006) method is divided into two steps. First, it locates the unknown location point of discontinuity. Then the potential tipping point candidate is tested using the regression discontinuity method. An important innovation introduced by Card et al. in order to use standard hypothesis testing involves splitting the city-specific sample(s) into two independent subsamples – two-third of the observations are used for the data-intensive tipping point search procedure, while the remainder one-third are used for statistically testing the hypothesis of discontinuity. While Card et al. explored two distinct methods in their search for candidate tipping points, the more robust ‘fixed point’ approach is used for the relatively small Dutch city samples. The alternative time-series structural break procedure has been deemed to perform well only in larger city samples (Card et al., 2006).

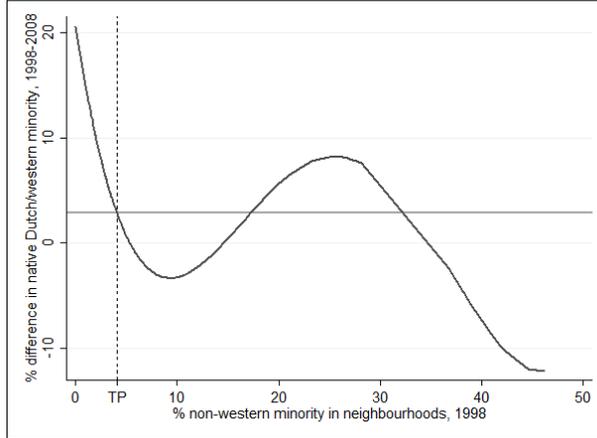
The ‘fixed point’ method first assumes the existence of a tipping point. It is designated as the unstable equilibrium point in neighbourhood ‘minority’ share where its ‘native’ population’s growth rate equals that of the city mean. Here, the city-specific growth rate that is averaged across all its neighbourhoods over the observation period serves as a reference point. For neighbourhoods with initial minority population below the tipping point value, its native population should have grown more than the city average during the observation period. Equally, for neighbourhoods with initial minority share beyond the tipping point, a relative decrease in native population is expected. Being an unstable equilibrium, the latter is hypothesised to tend towards minority-only population over time as the native population continues to leave the neighbourhood.

There can be more than one candidate tipping point and tipping point(s) can be derived from the intersection(s) between some growth function of neighbourhood native population and the city’s mean growth rate (see Figure 5.2). The smoothed growth function of native Dutch and western minority share with respect to non-western share is fitted using a global polynomial model following Card et al. (2008a, 2006). Given that global polynomial models are susceptible to outliers, the sample for each city is limited to neighbourhoods with not more than 50 percent non-western minority residents in 1999. The ‘50 percent’ threshold is set based on visual inspection which trims between 3.5 to 8.7 percent of the data in the three samples. The deviation between neighbourhood i ’s growth rate in native Dutch and western minority share (relative to initial neighbourhood population), $\Delta Y_i = (Y_{i,2008} - Y_{i,1998})/N_{i,1998}$ from its city j -specific mean growth rate, $\overline{\Delta Y_j}$ is fitted as a quartic polynomial of the neighbourhood share of non-western minority in the base year, $x_{i,1998}$ with the stochastic error term, ε_i :

$$\Delta Y_i - \overline{\Delta Y_j} = \sum_{p=0}^4 \lambda_p x_{i,1998}^p + \varepsilon_i. \quad (5.1)$$

The regression coefficients are then used to calculate the roots of the polynomial equation and the root with the most negative slope is considered a ‘tipping point’ candidate – e.g. the ‘TP’ example in Figure 5.2. Following Card et al. (2008a), the procedure is refined by fitting a quartic polynomial using a smaller sample within 10 percentage points from the previously identified root.

Figure 5.2: ‘Fixed point’ method



Note: Horizontal line represents the city-specific mean growth rate. ‘TP’ is tipping point.

Subsequently and using the sample of neighbourhoods not selected for the tipping point search procedure, the potential discontinuity effect of non-western minority share as deviated from its candidate tipping point, $(x_i - x_{tip})$ is tested on the growth rate in native Dutch and western minority share, ΔY_i . The following regression discontinuity specification is used:

$$\Delta Y_i = \sum_{p=0}^4 \alpha_p (x_{i,1998} - x_{tip})^p + d\mathbf{1}[x_{i,1998} > 0] + \beta \mathbf{Z}_{i,1998} + \varepsilon_i \quad (5.2)$$

where $d\mathbf{1}[x_i > 0]$ is an indicator variable taking the value one if the percentage of non-western inhabitants is larger than the ‘tipping point’ share, x_{tip} , and zero otherwise, while $\mathbf{Z}_{i,1998}$ represents the vector of neighbourhood covariates for the base year, and ε_i the random error term. Neighbourhood control variables pertaining to base year 1998/1999 include average housing price, residential density, share of households with children, share of elderly people above the age of 65, share of individuals reporting welfare benefit as their main source of income in 1998 (as a proportion to number of inhabitants aged 15 to 64), and percentage of rental housing from the housing stock (as of 2003 since earlier data is not

available⁵⁷). Residential density is measured from high to low based on the density of addresses. The results of the regression discontinuity models are reported in the following section.

5.4. Empirical findings

The tipping point search procedure has found potential tipping point candidates for the three multi-municipality conurbations: 2.90 percent of non-western minority for the Amsterdam metropolitan area, 9.75 percent for the Rotterdam-The Hague metropolitan area, and 6.22 percent for the Randstad metropolitan area. The candidate tipping point for the Amsterdam metropolitan region is considerably smaller than the other two samples – most likely due to the proportionally fewer non-western minorities in the suburban areas (see Table 5.1). Preliminary graphical analyses by means of Figure 5.3, Figure 5.4, and Figure 5.5 suggest that ‘tipping’ behaviour of growth in native Dutch and western minority share between 1998 and 2008 was not observed for all three samples.

Using two-thirds of each conurbation sample, the local polynomial fit of growth rate in native Dutch and western minority neighbourhood share during that period is plotted separately, before and after the tipping point, against share of non-western minority in 1998. The tipping point value derived from the two-stage polynomial search procedure is represented by the vertical line while crosses denote the observation points and the shaded area the 95 percent confidence interval.

⁵⁷ The exclusion of some of the variables reported in Table 5.1 is either due to the lack of pre-2004 data or the multicollinearity problem with those included in the final analysis.

Figure 5.3: Growth in native Dutch and western minority share on non-western minority share in Amsterdam, 1998-2008

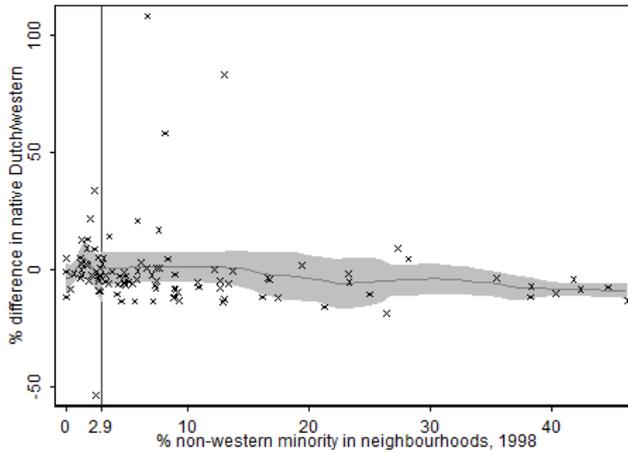
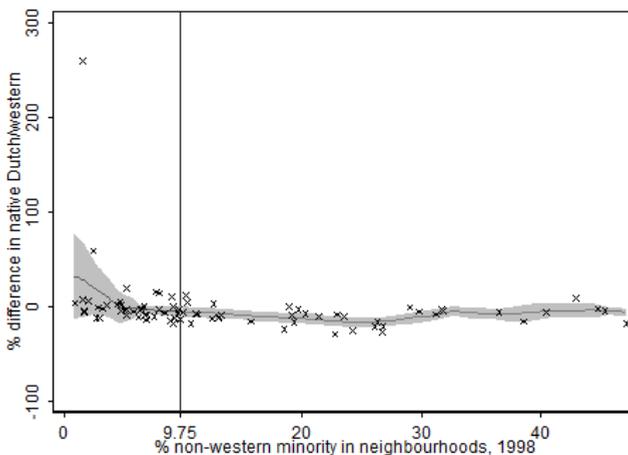
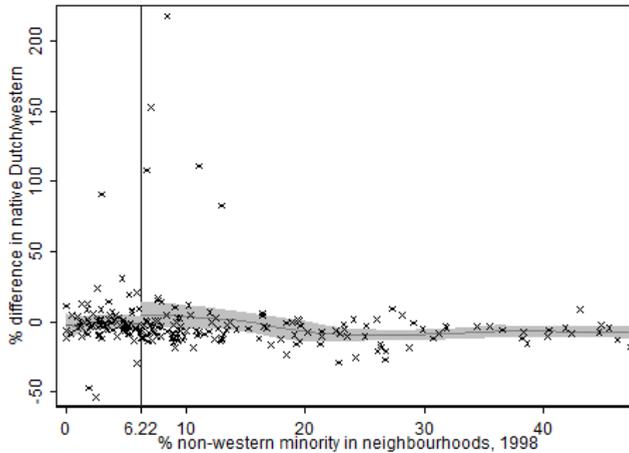


Figure 5.4: Growth in native Dutch and western minority share on non-western minority share in Rotterdam-The Hague, 1998-2008



Source: CBS (2010d), own calculations. The local polynomial fit of growth rate in native Dutch and western minority neighbourhood share between 1998 and 2008 is plotted before and after the tipping point against share in non-western minority in 1998 using two-thirds of each sample. Local polynomial estimate uses Epanechnikov kernel and rule-of-thumb bandwidth. Crosses denote the observation points, shaded area the 95 confidence interval, while the vertical line shows the tipping point derived from the two-stage polynomial search procedure.

Figure 5.5: Growth in native Dutch and western minority share on non-western minority share in Randstad, 1998-2008



Source: CBS (2010d), own calculations. The local polynomial fit of growth rate in native Dutch and western minority neighbourhood share between 1998 and 2008 is plotted before and after the tipping point against share in non-western minority in 1998 using two-thirds of each sample. Local polynomial estimate uses Epanechnikov kernel and rule-of-thumb bandwidth. Crosses denote the observation points, shaded area the 95 confidence interval, while the vertical line shows the tipping point derived from the two-stage polynomial search procedure.

This result was confirmed by the regression discontinuity tests of the tipping points for the respective conurbation samples in Table 5.2. The coefficients of the tipping point indicator variable exhibited contradicting effect signs depending on the sample and covariates and remained or became statistically insignificant. For example, 'tipping' was observed in the baseline model for the Rotterdam-The Hague metropolitan area, i.e. the mean growth rate difference in native Dutch and western minority share before and after the tipping point is 9.35 percentage points. However, the discontinuity indicator variable loses its statistical significance once quartic polynomial of non-western share and neighbourhood controls are included. While the smaller Amsterdam and Rotterdam-The Hague metropolitan samples could potentially suffer from low statistical power due to their small sample sizes, the non-significant result was consistent with the larger Randstad sample which consists of 47 municipalities, including the municipalities of Amsterdam, Rotterdam, and The Hague. Standard errors were allowed to cluster at the municipality-level for all samples. Statistically significant polynomial terms of non-western share for the Amsterdam and Randstad samples (not reported in Table 5.2) and the linear term for the Rotterdam-The Hague sample are indicative of the variable's explanatory power despite the lack of 'tipping point' effect.

Besides neighbourhood ethnic composition, socioeconomic and demographic covariates seem to be useful correlates for native Dutch and western minority growth rate. In particular, the proportion of households with children has a clear negative correlation, all things equal. The neighbourhood's native Dutch and western minority population experiences a mean negative growth of 0.59, 0.41, and 0.72 percentage points for every increase in the proportion of households with children in Amsterdam metropolitan, Rotterdam-The Hague metropolitan, and the Randstad respectively. Residential density as scaled from high to low hints at the suburbanisation preference of native Dutch and western minority households in the Randstad and Amsterdam metropolitan samples. And they prefer fewer renter neighbours since one percentage increase in rental housing is associated with a decrease of a quarter to half a percentage point in native Dutch and western minority growth in Amsterdam metropolitan and the Randstad. Interestingly, this group in the Randstad metropolitan region also appears disinclined to stay in neighbourhoods with more elderly inhabitants, i.e. every percentage point increase in share of elderly is correlated with a 0.61 percentage point decrease in native Dutch and western minority growth rate. Given the fact that the model does not account for the endogeneity and potential omitted variable bias with regards to the control variables, the relationship between these variables and the dependent variable is assumed to be non-causal.

Table 5.2: Regression discontinuity results for change in native Dutch and western share at tipping point, 1998-2008

	Amsterdam Metropolitan		Rotterdam – The Hague		Randstad Metropolitan		
Beyond Tipping Point (TP)	2.08 (4.63)	4.00 (4.47)	-2.55 (5.75)	1.42 (5.79)	12.04 (7.42)	8.01 (6.60)	7.65 (8.46)
Non-western minus TP (%)	-0.26** (0.10)	0.08 (0.30)	2.46 (1.50)	-0.29 (0.35)	-1.81** (0.71)	-0.48** (0.19)	0.31 (1.08)
Rental housing (%)		-0.28* (0.14)	-0.26* (0.15)	-0.04 (0.12)	0.07 (0.17)	-0.46* (0.25)	-0.48* (0.25)
Average house price ('000)		-0.07 (0.04)	-0.07 (0.04)	-0.12 (0.15)	-0.07 (0.10)	-0.05 (0.04)	-0.06 (0.05)
Residential density		4.09 (2.48)	4.52* (2.57)	13.30 (11.64)	8.63 (7.54)	5.16** (2.29)	5.67** (2.61)
Welfare recipients (%)		-0.35 (0.50)	-0.48 (0.51)	-1.27 (1.50)	-1.10 (1.34)	-0.19 (0.23)	-0.16 (0.24)
Households with kids (%)		-0.58** (0.24)	-0.59** (0.25)	-0.40* (0.21)	-0.41* (0.22)	-0.67** (0.26)	-0.72** (0.28)
Elderly > 65 years (%)		-0.47 (0.29)	-0.37 (0.28)	0.31 (0.89)	0.01 (0.64)	-0.62*** (0.22)	-0.61*** (0.22)
Quartic in non-western minus TP (%)	No	No	Yes	No	Yes	No	Yes
Number of neighbourhoods	102	83	83	80	75	213	188
Adjusted R ²	0.001	0.048	0.020	0.033	0.062	0.019	0.152

Source: CBS (2013c, 2010d). Two-tailed significance: * p<0.10, ** p<0.05, *** p<0.01. Neighbourhood covariates pertain to 1998/1999 except share of rental housing (2003). The standard errors in parentheses are clustered at the municipality-level. 'Residential density' is measured from very high (1) to very low (5).

5.5. Why neighbourhoods in Dutch big cities did not tip

As outlined in the chapter introduction, ‘tipping points’ in neighbourhood composition change, if they exist, could theoretically assist preventive area-based policies by targeting neighbourhoods prior to their ‘tip’. However, if we find a lack of ‘tipping point’ behaviour in neighbourhood turnover, this hints at the effectiveness of the related policies that are already in place. In the following section, this section outlines several key hypotheses that could shed light on the lack of ‘tipping’ behaviour in native Dutch and western growth rate between 1998 and 2008 with respect to initial non-western share.

5.5.1. Data: Observation period and neighbourhood definition

Since the relevant neighbourhood administrative data is only available from 1998, it is likely that this study has missed out on most of the ‘tipping’ phenomena in big city neighbourhoods. For instance, mass suburbanisation of native Dutch households in large cities had begun in various cities from the 1960s onwards (Bontje and Latten, 2005; Dieleman and Wallet, 2003). Although this study encompasses the suburban neighbourhoods within the metropolitan regions, it is likely that the spatial ‘dichotomisation’ has already occurred prior to 1998 – akin to Farley et al.’s (1978) ‘chocolate city, vanilla suburbs’ analogy. As a matter of fact, non-western minority household have largely bucked the suburbanisation trend (Zorlu, 2009) or if they do, they tend to re-concentrate with fellow ethnic households (Burgers and van der Lugt, 2006). Besides ‘white avoidance’, ‘minority avoidance’ could be at play here.

Excluding the outliers, growth rate in native Dutch and western minority with respect to initial non-western share hovers close to zero percent as seen in Figure 5.3, Figure 5.4, and Figure 5.5. For this to happen within the tight housing market (low vacancy rate of 2.2 percent in 2007, see Ministerie van VROM 2007b), one would imagine the out-migration of households from a neighbourhood to roughly correspond with the in-migration of households of similar ethnicity. Barring incidences of racial discrimination, the selectivity in residential mobility could be due to ethnic differences in housing and neighbourhood characteristics, including neighbourhood ethnic composition (see Chapter 2 on heterogeneous preferences among homeowners in the Netherlands).

Another possible issue relates to the definition of ‘neighbourhood’ or the areal unit of interest. The four-digit postcode neighbourhood used in this study could be too large, spatially and population-wise, or functionally incoherent compared to the

smaller *buurt* neighbourhood definition. The departure of native Dutch households from ‘non-western minority’ concentration neighbourhoods has been recorded at the smaller six-position postcode neighbourhood or block-level in Amsterdam (Musterd and Deurloo, 2002; Musterd and De Vos, 2007). The sensitivity of spatial-based measures and analysis to the definition of areal units such as a neighbourhood is known as the ‘modifiable areal unit problem’ (c.f. Fotheringham and Wong, 1991). Spatial segregation studies have found different levels of segregation depending on which areal unit is used, e.g. the smaller *ilots* (Verdugo, 2011) or the larger *communes* (Rathelot and Safi, 2013) in France. Moreover, residential mobility decision depends on the individual household’s subjective perception of what constitutes the neighbourhood and thus, the perceived level of neighbourhood ethnic segregation (Guo and Bhat, 2007).

5.5.2. Methodology: Minority definition and statistical power

For the main analysis, the dichotomous ‘native Dutch and western’ versus ‘non-western’ social grouping was used. While valid and justifiable, it is contentious because the western minority group could also be inserted as a right-hand side explanatory variable instead, either as a separate covariate or combined with the non-western group to form a general ‘minority’ category (see also “minority definition” in Card et al., 2008a). As a form of robustness check, the analysis was re-run with growth rate in native Dutch share as the dependent variable and ‘minority’ share as the main variable of interest, see Table 5.3. The tipping point candidates remain statistically insignificant as the results reproduce similar conclusions derived from Table 5.2 using the initial dichotomous categorisation.

Compared to the large North American city samples of Card et al. (2008a), this study could potentially suffer from low statistical power due to the Dutch metropolitan regions’ small sample sizes and the use of Card et al.’s data intensive, ‘tipping point’ search methodology. If there is indeed a ‘tipping point’ effect, the low statistical power is translated into a higher probability for making a ‘false negative’ or ‘Type II’ error, i.e. failing to reject the null hypothesis of no ‘tipping point’ effect when it is indeed false. Even so, the lack of statistically significant result for the larger Randstad agglomeration sample is arguably indicative of the true relationship between the growth in neighbourhood share of native Dutch and western share with respect to its share of non-western minority.

Table 5.3: Regression discontinuity results for change in Native Dutch share at tipping point, 1998-2008

	Amsterdam Metropolitan		Rotterdam – The Hague		Randstad Metropolitan		
	No	Yes	No	Yes	No	Yes	
Beyond Tipping Point	3.54 (4.70)	4.85 (4.49)	8.24 (15.40)	-0.80 (8.86)	2.50 (6.43)	3.13 (7.76)	4.18 (10.02)
Minority minus TP (%)	-0.25*** (0.09)	0.82 (0.53)	-0.88 (0.88)	-0.03 (0.21)	-0.34* (0.18)	-0.18 (0.16)	-0.17 (0.57)
Rental housing (%)		-0.25* (0.13)		0.05 (0.10)		-0.34 (0.23)	-0.31 (0.23)
Average house price (000)		-0.07 (0.04)		-0.08 (0.15)		-0.03 (0.05)	0.01 (0.05)
Residential density		4.11* (2.34)		11.43 (9.63)		3.75 (2.35)	4.01* (2.04)
Welfare recipients (%)		-0.33 (0.34)		-0.86 (1.04)		-0.09 (0.19)	-0.16 (0.20)
Households with kids (%)		-0.48** (0.21)		-0.38** (0.17)		-0.54** (0.23)	-0.64** (0.25)
Elderly > 65 years (%)		-0.38 (0.27)		-0.05 (0.47)		-0.68** (0.28)	-0.72** (0.30)
Quartic in minority minus TP (%)	No	Yes	No	Yes	No	Yes	Yes
Number of neighbourhoods	102	83	80	75	213	188	188
Adjusted R ²	0.005	0.030	0.058	0.084	0.014	0.135	0.134

Source: CBS (2013c, 2010d). Two-tailed significance: * p<0.10, ** p<0.05, *** p<0.01. Neighbourhood covariates pertain to 1998/1999 except share of rental housing (2003). The standard errors in parentheses are clustered at the municipality-level. 'Residential density' is measured from very high (1) to very low (5).

5.5.3. Government policies

Current literature on ‘tipping point’ in neighbourhood ethnic composition is limited by the North American scope. The Netherlands differs substantially in several ways which are summarised by the three main factors relevant to this study: (i) a large social housing sector, (ii) centralised tax and redistributive regime, and (iii) the strong regulatory role of the state in housing and urban planning.

Unlike North American cities, only slightly more than half of the large Dutch city housing stock comprise of homeowner dwellings (see Table 5.1). There is also an unusually large social housing sector occupying up to 37 percent of the total national stock or 75 percent of rented dwellings in 2007 (Ministerie van VROM 2007b). This was the result of decades-long state subsidised housing construction by housing associations which was later stemmed in the mid-1990s. ‘Grossing up’ (*brutering*) annulled the associations’ outstanding state loans in the place of future construction subsidies. Quite uniquely, the Dutch social housing sector supports socially integrated neighbourhoods as it is socially differentiated and not stigmatised (e.g. as compared to council housing in the United Kingdom). This reality however is not static with the growing homeownership sector at the expense of social housing stock. The latter is heading towards ‘residualisation’, i.e. catering only to low-income or socially disadvantaged households (van Kempen and Priemus, 2002). Migrant households of non-western origin are especially likely to be social housing tenants – 66 percent in 2006 compared to 31 percent for native Dutch households and 43 percent for western minority households nationwide (see Table 5.4).

Table 5.4: Housing tenure type by ethnicity, 2006

	Native Dutch	Non-western	Western
Homeownership	59.26	22.61	42.86
Social rental	30.56	66.23	42.93
Private rental	8.21	9.16	12.29

Source: Housing Survey (Ministerie van VROM 2006), own calculation with household weights.

Centralised tax regime and redistribution reduce the influence of neighbourhood amenities and the Tiebout-sorting prevalent in the United States (e.g. Bayer et al., 2004). The budget of local municipalities that are responsible for urban planning is largely – 83 percent in 2001 – drawn from general tax revenues and not local taxation (Van Der Burg and Dieleman, 2004). Under the ‘Big City Policy’, the Amsterdam and Utrecht municipalities received approximately €1.8 billion and

€428 million (respectively €2,456 and €1,642 per capita) from the national government between 1999 and 2003 (Aalbers et al., 2004). Moreover, local amenities like schools are almost universally funded by central government coffers (Ladd and Fiske, 2009a). Redistribution also involves social transfers with low-income, single-household occupants of both social and private rental dwellings eligible for government rental subsidy (*huurtoeslag*) as long as the rent is below the specified threshold (€699.48 excluding utilities for 2014, see Rijksoverheid, 2014).

One could argue that housing stock diversification via urban renewal programmes (outlined in the chapter introduction) is inevitable for a densely populated country with scarce land for new construction (also noted in Kruythoff, 2003). Furthermore, the public role in urban planning is necessary with the unusually large social rented housing sector administered by local housing associations. For instance, the Bijlmer neighbourhood in Amsterdam was expected to see a decrease in social housing stock from 93 to 55 percent by demolishing half of the 12,500 flat units (Aalbers et al., 2004). ‘Social mixing’ continues to be featured prominently in urban planning policies (2007a, 1997, Ministerie van VROM 1996; 1990; VROM-raad, 2001). Altogether these policies are extensive, costly, and reflect the shift within the Dutch policy tradition of using spatial measures outlined in Table 5.5.

Table 5.5: Overview of post-war urban policies in the Netherlands

Policy Name	Main Goal	Period	Orientation	Slogan
Creating CBDs	Stronger urban economy	To 1970	Efficiency	New jobs
Urban renewal	Improving urban housing	1970-1980	Social justice	New housing for neighbourhood
City renewal	Stronger urban economy	1980-1990	Efficiency	Stop urban degradation
Multiple-problem	Help disadvantaged neighbourhoods	1985-1990	Social justice	Stop cumulating problems
Social renewal	More social cohesion	1990-1994	Social justice	Higher participation
Big City Policy I	Mixed neighbourhoods	1994-1998	Social justice	Immigration of high incomes
Big City Policy II	Stable neighbourhoods	1998-2004	Social justice	Prevent leaving neighbourhood
Big City Policy III	Stronger neighbourhoods	2004-2009	Efficiency	Powerful cities
Big Cities Policy+	Integrated neighbourhoods	From 2007	Social justice	Prevent parallel societies

Source: Musterd and Ostendorf (2008). ‘CBDs’ refers to ‘central business districts’ created within cities. ‘Big Cities Policy+’ includes the ‘Vogelaar’ or ‘Priority Neighbourhoods’ policy.

All the factors mentioned above basically reduces the leverage of market mechanisms in the Dutch housing market (c.f. Vermeulen and Rouwendal, 2007) that would have otherwise resulted in high levels of neighbourhood segregation observed in the United States and elsewhere (among others, see Massey and Denton, 1993; Musterd, 2005; Wilson, 1987).

5.6. Conclusion and policy implications

The main aim of this chapter was to test the potential 'tipping point' dynamic in neighbourhood ethnic composition that has been documented in North American studies (e.g. Card et al., 2008a). For comparability, the same methodology by Card et al. (2008a, 2006) was applied to three Dutch conurbations – the Amsterdam metropolitan area, the Rotterdam-The Hague metropolitan area, and the Randstad metropolitan area – using administrative neighbourhood data from 1998 to 2008. This study fails to find 'tipping point' behaviour in decadal growth of native Dutch and western minority neighbourhood share with respect to initial share of non-western residents, despite their negative statistical association. The previous sections have highlighted the possible data and methodological limitations. More importantly, this chapter outlines three main factors that downplay the market mechanism usually responsible for neighbourhood ethnic segregation. They are: (i) a large social housing sector, (ii) a centralised tax and redistributive regime, and (iii) the strong regulatory role of the state in housing and urban planning. Essentially, if 'social mixing' remains the main objective in urban planning, the lack of 'tipping point' dynamic in neighbourhood ethnic change offers some limited support to the present policy practices in the Netherlands.

5.7. Appendix

Data

The neighbourhood data used in this chapter comprise of two neighbourhood datasets from Statistics Netherlands (or Centraal Bureau voor de Statistiek, CBS): the 'Population and Household Data by Four-Digit Postcode' (CBS 2010d) and the 'Neighbourhood Key Figures, 1995-2012' (CBS 2013c). The latter dataset defines neighbourhood by the administrative definition (*buurt*) which is collapsed into the larger spatial aggregation four-digit postcode neighbourhood used in this study. The '*buurt*' neighbourhood is not a complete subset of the four-digit postcode area, i.e. there could be more than one four-digit postcode address within each '*buurt*' neighbourhood, so the most common four-digit postcode is used. There are, on average, three '*buurt*' neighbourhoods per four-digit postcode area. Residential density is originally based on the number of addresses per km² measured at the *buurt*-level on a five-point scale: 1 = at least 2,500 addresses, 2 = 1,500 to 2,500 addresses, 3 = 1,000 to 1,500 addresses, 4 = 500 to 1,000 addresses, and 5 = less than 500 addresses. Neighbourhood data is also available for years 1995 and 1997 but the 'non-western' minority category is limited to those of Turkish, Moroccan, Surinamese, Dutch Antillean, and Aruban descent.

Indicator variables were created in addition to the datasets to define the three conurbation areas. The 'Randstad' urban agglomeration is defined to be equivalent to the municipalities under four Dutch provinces: Noord-Holland, Zuid-Holland, Flevoland, and Utrecht (for more information on the Randstad, see Hendriks, 2006). The 'Amsterdam Metropolitan Region' refers to 36 Dutch municipalities: Aalsmeer, Almere, Amstelveen, Amsterdam, Beemster, Beverwijk, Blaricum, Bloemendaal, Bussum, Diemen, Edam-Volendam, Haarlem, Haarlemmerliede-Spaarnwoude, Haarlemmermeer, Heemskerk, Heemstede, Hilversum, Huizen, Landsmeer, Laren, Lelystad, Muiden, Naarden, Oostzaan, Ouder-Amstel, Purmerend, Uitgeest, Uithoorn, Velsen, Waterland, Weesp, Wijdemeren, Wormerland, Zaanstad, Zandvoort, Zeevang (Metropoolregio Amsterdam, n.d.). While the 'Rotterdam-The Hague Metropolitan Region' include 24 Dutch municipalities: Albrandswaard, Barendrecht, Bernisse, Brielle, Capelle aan den IJssel, Delft, Den Haag, Hellevoetsluis, Krimpen aan den IJssel, Lansingerland, Leidschendam-Voorburg, Maassluis, Midden-Delfland, Pijnacker-Nootdorp, Ridderkerk, Rijswijk, Rotterdam, Schiedam, Spijkenisse, Vlaardingen, Wassenaar, Westland, Westvoorne, Zoetermeer (Metropoolregio Rotterdam Den Haag, 2013).

6. General conclusion and discussion

The three main themes of ethnic segregation identified in the thesis introduction – preferences for peer composition, nonlinear dynamics in peer composition, and peer effects of segregation – have been covered across the four empirical chapters of this thesis. With the growing need of evidence-based policymaking and the availability of relevant micro-data, the thesis emphasises the immense potential for neoclassical economics and preference-based research on ethnic segregation. The following section summarises the key conclusions and corresponding policy implications before concluding with recommendations for future research.

6.1. Main conclusions and policy implications

I. Segregation outcomes are mediated by policies that influence choice via ‘bundling’ possibilities

Housing, school, and neighbourhood characteristics that simultaneously shape residential location and school choices can be viewed as a bundle of quality attributes. This was evident in Chapters 2 and 3 which dealt with household choices for housing and primary school respectively. Chapter 3 highlighted the prevailing of residence-to-school distance as the main determinant of school choice. With the ‘bundling’ nature of housing, school, and neighbourhoods firmly established, the main finding when relating household preferences to segregation outcomes is the relatively large role policymakers play in mediating household preferences. As highlighted in Chapters 2, 3, and 5, policymakers in the Netherlands yield considerable influence on the ‘bundling’ process given the highly regulatory nature of the housing, education, and urban planning systems. But policies interact in various ways and can either reinforce or undermine each other’s effects on segregation outcomes. For example, since non-western minority status is still negatively correlated with socioeconomic status, segregation is expected to be higher without income redistribution and near-universal state funding (as opposed to local tax funding) of neighbourhood amenities like schools (as suggested in Chapter 5). Yet the same government funding and support of school ‘bundling’ differentiation have been found to be encouraging school segregation preferences of parents (Chapter 3). Another way to look at it is that while these policies reduce income-based segregation (e.g. in neighbourhoods, see Chapter 5), they increase sorting based on non-income factors such as peer ethnicity and school type. Chapter 3 illustrated the problem when policymakers reduced the number of Islamic school alternatives, students reconcentrate into the few remaining Islamic schools. The main policy implication for policymakers keen

on integrated neighbourhoods and schools would be to influence the bundling process, e.g. by limiting the share of students of disadvantaged background (which correlates highly with ethnicity).

II. A higher neighbourhood share of non-western minority residents is associated with lower average dwelling price

Using the larger sample for The Hague, the results from Chapter 2 predicts an average decrease in dwelling price of €697 for every 10 percent increase in non-western neighbours when other housing and neighbourhood variables are held at their median or mode values. However, by accounting only for mean neighbourhood dwelling price without the neighbourhood share of renters (especially social renters), the estimated implicit price could be biased upwards.

III. Non-western minority homeowners do not prefer to live with more co-ethnic non-western minority neighbours

Previous research observed that households of migrant background have a preference or higher tolerance for living with their co-ethnics or other migrant groups, compared to the native or dominant group. Based on the Dutch Housing Survey, the study in Chapter 2 did not find the expected positive preference of non-western homeowners for more co-ethnic neighbours or a negative preference of native Dutch homeowners for more non-western neighbours. On the contrary, it finds evidence of spatial assimilation amongst non-western minority homeowners. While the median non-western homeowner is relatively indifferent towards neighbourhood ethnic composition, the results confirm that at least some prefer *not* to live with more non-western households. Chapter 2 also finds an increase in rate of homeownership amongst non-western minority households. Especially for countries where homeownership is less pervasive like the Netherlands, homeownership by households of migrant background itself can be additionally interpreted as their long-term commitment to the host society. Given this evidence, policymakers have homeownership as a potential instrument to reduce barriers of socio-spatial mobility and assimilation, e.g. discrimination in the housing market. The problem in the Netherlands may be less severe due to its anti-discrimination laws and national mortgage guarantee (*Nationale Hypotheek Garantie, NHG*) that assists disadvantaged households in securing mortgages. Yet without specialised laws such as the US Home Mortgage Disclosure Act (HMDA), Aalbers (2007) found evidence of 'exclusionary practices' against ethnic minority households and neighbourhoods amongst 'grey area' applicants, i.e. those subject to the discretion of loan officers because they do not live up to the formal acceptance criteria of banks. Legislators could look into introducing similar specialised laws to tackle such exclusionary practices in the Dutch housing market.

IV. Non-western minority students in religious schools prefer schools with more non-western minority peers

School type, religious denomination, distance, and ethnicity are key determinants of school choice in the literature. From Chapter 3, we know that the students in the data sample have self-selected themselves into the segregated religious schools and continue to do so in their subsequent school mobility, whether voluntary or involuntary. Every percentage point increase in non-western minority peers is associated with a 2 and 7 percent increase in odds of school choice for voluntary movers and forced movers (from school closure) respectively. We also know that primary school choice is a nested decision, or in other words, parents prioritise the choice of school type before selecting schools within the school type based on a set of school attributes. Accounting for the nested structure in choice reduces the bias in estimating the effects of other determinants such as peer ethnicity. When school choice is first nested on school denomination, a one percentage point increase in non-western peers doubles the odds of school choice to 14 percent for those affected by the school closure. In comparison, distance-to-school remains the strongest determinant, e.g. for those affected by the school closure, every kilometre in additional distance reduces the odds of selecting a school by 45 to 76 percent (the larger estimate when school choice is estimated as nested on school type). School choice is also nested on religious denomination for students enrolled in Islamic schools with demand for such schools exceeding supply. The policy implication here is that while school attributes such as peer composition and distance are relevant predictors for school choice, school type or religious denomination may trump them all for some groups of students. This appears to be a main policy concern as Islamic schools tend to be mono-ethnic as well. Chapter 3 highlighted the inconsistencies between parental choice enshrined in the national constitution, the lack of real substitute school alternatives, and policymakers' desire to disperse the students from the closed schools. A clearer policy stand – ideally supported by research evidence – on the fate of school segregation and religious schools would ensure greater consistency in policymaking (c.f. Driessen and Merry, 2006).

V. Native Dutch students have a higher probability of high school dropout if they had predominantly non-western minority peers in primary school

While the ethnic minorities more often play the role of 'minority' in the public sphere, the native Dutch majority do not appear to do well in the 'minority' position. Native Dutch students in predominantly non-western minority primary schools experience a higher likelihood of high school dropout (see Chapter 4). The conditional probability of school dropout increases by 5.4 percent points to 8.0 percent if 'school stable' native Dutch students were enrolled in primary schools with more than 77.7 percent non-western minority students. This diverges from the previously established insignificant effect of migrant student peers on native ethnic

students (e.g. Ohinata and Ours, 2011 for the Netherlands). Definitional difference on the concept of 'peers' (ethnic composition is measured at the primary school-level) aside, the study in Chapter 4 has controlled for school mobility. This isolates the potentially 'at-risk' students who experience different underlying forces in their school behaviour and outcomes (c.f. Bowditch, 1993). Chapter 4 also confirms the long-term effects of primary school conditions and student behaviour. Frequent school movers during primary schooling have a 2.6 times higher likelihood of dropping out from high school after controlling for various individual, school, and neighbourhood characteristics. Policy-wise, this offers some support to the aforementioned parliamentary initiative of capping the proportion of socially disadvantaged students in new schools at 80% (Tweede Kamer, 2005, 2004b), albeit in the interest of 'minority' native Dutch students rather than the non-western minority students themselves.

VI. Dutch policies toward integrated neighbourhoods have been 'successful'

Chapters 2 and 3 on housing, neighbourhood, and school choices illustrate the importance of peer ethnic composition. But ethnic composition is but one of many determinants and it is this multidimensionality that allows for semi-stable 'integrated' neighbourhoods or schools (c.f. Card et al., 2008b). Previous research verified the existence of micro-preference for peer composition. Chapter 5 concurs with evidence of 'white flight' in the form of a negative statistical association between decadal growth of native Dutch and western minority neighbourhood share and the initial share of non-western residents at base year. While some native Dutch and western minority households did flee or avoid neighbourhoods with non-western minority share beyond a certain threshold, this effect on neighbourhood segregation was limited. These at-risk neighbourhoods did not 'tip' towards hyper-segregated ethnic enclaves during the observation period. Dutch policymakers appear to have hit the jackpot in preventing neighbourhoods from 'tipping' into ethnic enclaves. Several factors have most likely reduced the potency of market mechanisms responsible for self-segregation. First, the unusually large social housing sector supports socially integrated neighbourhoods as it is socially differentiated and not marginalised to the low socioeconomic group. Second, taxation is mostly centralised and heavily redistributed across municipalities while local amenities such as schools are almost universally funded by the central government. Last but not least, the housing stock diversification and urban renewal programmes may have stemmed or even reversed the 'tipping' tendency of at-risk neighbourhoods. From a policy perspective, spatial planners could monitor the development of critical thresholds in neighbourhood composition trends so that these thresholds (should they exist) can be incorporated in designing of preventive rather than curative neighbourhood policies. More appears to be gained by combining housing policy with socio-spatial assimilation

policy, e.g. by reducing barriers to ethnic minority homeownership as mentioned above.

6.2. Potential avenues for future research

Research on the self-selection and discrimination faced by non-western minorities in the owner occupation sector is uncommon in the Netherlands (the few exceptions being Aalbers, 2007, 2005). With the growing share of non-western minority homeowners – almost a quarter of non-western minority households in 2006 – this subfield of research can no longer be ignored. Empirical studies can test the effect of the ‘exclusionary practices’ identified in qualitative studies to see if non-western minorities have indeed been hindered from acquiring mortgages. Besides external discrimination, non-western minority households are most likely self-selected to become homeowners. Future studies could look into the other constraints to homeownership afflicting the predominantly ‘social renter’ non-western minority community. It is plausible to imagine that the present owner occupation dwellings (within an affordable price range) are not attractive to non-western minority households. While this thesis has only examined household willingness to pay for neighbourhood ethnic composition, more can be achieved with hedonic pricing methods within a heterogeneous preference framework. For instance, they can help identify the relative desirability of other housing and neighbourhood attributes for the respective consumer groups.

The rareness of school closures and the related literature highlights the need for such research to aid future education policymaking. The findings in Chapter 3 caution policymakers on students’ penchant for re-concentrating instead of dispersal after a policy intervention such as forced school closure. Further research with additional explanatory variables for school choice, especially with a larger, more general sample of students and schools is crucial. Armed with a more complete picture of the determinants of school choice, similar policy interventions in the future could then ensure the availability of desirable school substitutes to those affected prior to policy implementation.

Another education topic for future research pertains to the under-researched effect of being in a predominantly non-western minority school on native Dutch students. While the effect of being in an ethnic minority-dominant school is typically found to be larger and statistically significant for the minority students themselves, a few studies have shown that it could also affect native or ethnic majority students. Making use of administrative data without key information such as parental education, the empirical strategy in Chapter 5 relied on regression discontinuity method. It made the strong but justifiable assumption that parents do not observe and self-select themselves into schools located before and after the

endogenously identified '77.7' threshold in the proportion of non-western minority school peers. Future studies could consider similar quasi-experimental empirical approaches if relying on secondary data, or experimental data and methods in order to determine peer effect. As a matter of fact, with the last census conducted in the Netherlands in 1971, the statistical office should consider collecting administrative data on vital socioeconomic indicators such as highest attained parental education in order for future research to disentangle socioeconomic segregation from ethnic segregation. Other important research and policy-relevant questions include the characteristics of native or ethnic majority students who self-select themselves into enrolling in ethnic minority-dominant schools, and if this effect is consistently observed across other cities and countries with different ethnic relations.

Also under-researched is the non-linear change of neighbourhood ethnic composition outside of the United States. The empirical focus in Western Europe is currently limited to the phenomenon of 'white flight', i.e. the departure of native households in response to the increasing arrival of minorities and the self-segregation behaviour of ethnic minorities. 'White flight' alone is a necessary but not a sufficient condition for segregation outcomes. Chapter 5 contains the first empirical study on neighbourhood tipping points for the Netherlands which should ideally be complemented by further research in other West European countries, especially those with larger metropolitan areas. Since the study does not rule out the possibility of neighbourhoods having 'tipped' prior to the observation period, increasing the time span of the analysis would provide more robust results.

6.3. Concluding remarks

Reflecting on the first figure of the dissertation regarding the rise and fall of segregation research, the next decade would most certainly witness the continual rise in the field of ethnic segregation. Western Europe will keep its present momentum to produce more comparative research and a wide range of innovative policies aimed at balancing the conflicting demands of social equality, immigration, migrant integration, and minority rights.

The challenges of diversity are accompanied by two recent, unfamiliar phenomena in Dutch post-war history: the growth in socioeconomic inequality and the liberalisation of the housing market at the expense of its large social housing sector. Together with existing segregation drivers such as strong parental choice for schools, preferences of those socially advantaged are expected to drive the housing and school markets. Given the large overlap between socioeconomic status and ethnicity, ethnic segregation will most likely be amplified. In

counteracting the latter, Dutch policy interventions will need to incorporate the effects of preferences and choice more than ever before.

But in order to design appropriate policies and achieve migrant integration, policymakers would first need to define the desired 'assimilation' ideal. 'Assimilation' is often equated with upward social mobility given the historically low socioeconomic status of most migrants at the point of entry. However, this neglects the social class structure of the native population. Migrants can end up assimilating into a range of social classes. Some of the non-western minorities have assimilated into the middle and higher socioeconomic strata – this is suggested in the finding of Chapter 2 on the socio-spatial assimilation of non-western homeowners. However, many are still concentrated in lower vocational education and social housing. The main concern is that they have assimilated into the low socioeconomic stratum of Dutch society and now face the double barriers to social mobility from their migrant and low socioeconomic statuses. Beyond socioeconomic assimilation, there remains a political question that needs to be addressed before consistent policies can be made. The present Dutch polity will have to reconcile the contradictions between the demands of non-socioeconomic preferences such as peer ethnicity in schools (Chapter 3) that may impede the integration between its native and minority groups.

Lastly and perhaps most contentiously, the reality of 'immigrant nation' is here to stay until, by statistical definition, the migrant group graduates into the third-generation and beyond. For a truly equal society for all groups, one would need to acknowledge nation-building to be an ongoing process and not a static historical concept. Just as migrants adapt and assimilate, the host societies are irrevocably changed from the experience of immigration.

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Summary

The thesis begins by making a case for a West European country case study of ethnic segregation and migrant integration as these countries confront their unintended transformation into 'immigrant nations'. The last decades have given way to key policies in Western Europe that influence neighbourhood segregation, e.g. large-scale urban renewal policies such as the London Docklands Development Corporation from the 1980s and the European Union's URBAN programme from the 1990s. More recently, migration and migrant-related policy and research have flourished nationally and internationally, e.g. the EU Hague Programme on common indicators for migrant integration in 2004 and the European Commission-sponsored research consortium, *International Migration, Integration and Social Cohesion in Europe* (IMISCOE). Besides the need of evidence-based policymaking, the emergent micro and spatial data render Western Europe a rich laboratory for ethnic segregation research.

There are multiple ways to study ethnic segregation's causes and effects, one of which is the neoclassical economics approach. With the view of individuals as rational, utility-maximising agents with perfect information to realise their preferences within financial constraints, it focuses on preferences as a source of segregation. Preferences tend to be heterogeneous and this thesis is premised on ethnic differences in preferences as a cause of segregation. This assumes housing, neighbourhood, and school attributes to be unevenly distributed. To complete the picture, neoclassical economics can be extended to include social interactive effects of preferences and the external constraints that influence choices and segregation outcomes. Since the neoclassical economics framework has been largely limited to North American segregation studies, an application to Western Europe would make an integral contribution to the literature. A country like the Netherlands has different native-migrant social dynamics and a larger role of the welfare state in mediating social inequality and the market effects of preference per se. The obvious question would be how these qualities affect segregation outcomes in the country.

This thesis covers the topic of ethnic segregation in the Netherlands over three main dimensions – housing, schools, and neighbourhoods – and four empirical chapters. Causes of segregation in the form of heterogeneous preferences, especially for peer composition (Chapters 2 and 3), and nonlinear dynamics in peer composition have been explored (Chapters 4 and 5) alongside the effect of segregation in the form of school peer compositional effects (Chapters 4).

Housing, school, and neighbourhood characteristics that simultaneously shape residential location and school choices can be viewed as a bundle of quality attributes. Hedonic pricing and discrete choice models are two dominant methods for modelling choice and preferences. The appropriateness of each method dependent on the product space, i.e. if it is dense with products of varying levels of attribute composition (suited for price hedonic models), or if it consists of few discrete alternatives (where discrete choice models are advisable). Chapters 2 and 3 provide interesting applications of both methods on the Dutch housing and primary school 'markets' respectively. Chapter 2 utilised a price hedonic framework to decompose each housing choice into a basket of distinct housing and neighbourhood utility-deriving components and estimated their respective 'implicit prices'. Chapter 3 used a discrete choice framework instead to model the relative (lack of) importance of each school and school peer attribute in determining actual school choice.

Chapter 2 examines preferences for housing and neighbourhood attributes among homeowners in the Netherlands. Do native Dutch and non-western minority homeowners have different preferences for neighbourhood ethnic composition? In order to answer that question, the researcher should be conscious of the fact that households do not make housing choices purely based on one feature but rather that is traded off with other characteristics of varying levels of importance. Based on the larger sample for The Hague from the Dutch Housing Survey, the empirical results predicts an average decrease in dwelling price of €697 for every 10 percent increase in non-western neighbours when other housing and neighbourhood variables are held at their median or mode values. While the median non-western homeowner is relatively indifferent towards neighbourhood ethnic composition, the results confirm that at least some prefer *not* to live with more non-western households. This is, in essence, a test of the assimilation theory in the Netherlands, i.e. if homeowners of non-western migrant background have a negative willingness to pay for living next to more co-ethnic neighbours.

Chapter 3 evaluates the school choices of predominantly non-western students following the forced school closure of three segregated schools in Amsterdam. It relies on data provided by school enrolment records that are linked to public school funding and personnel data from the Ministry of Education, Culture, and Science. After the school closure, did the students re-concentrate into the same school(s) or did they disperse into different schools? By taking into account the various school choices of these students, the chapter can identify their relative preference for schools with more (or less) peers of their own ethnic and socioeconomic background. It also considers the likelihood of parents prioritising the choice of school type or religious denomination before selecting schools within the school type. When this is accounted for in the analysis, a one percentage point

increase in non-western peers is found to double the odds of school choice to 14 percent. The chapter contributes to policymaking by testing the idea that school types or religious denominations are not equal in the eyes of (some) parents. As part of future policy interventions, policymakers should first identify the determinants of school choice and the availability of desirable school substitutes for students and parents.

Chapter 4 investigates the influences of ethnic composition and school mobility at the primary school-level on the propensity to drop out of high school in Amsterdam. Is there an effect of ethnic school composition on the likelihood of school dropout? Since a binding outcome such as school dropout is expected to be caused by long-term cumulative factors, the ideal data would involve observing the sample from a fairly young age. Chapter 4 does so with a unique, restricted-access administrative data linking primary school factors – such as peer ethnicity and school mobility – to a high school outcome. To establish causality, a discontinuity in the predicted probability of school dropout with respect to the share of non-western school peers is determined and tested. The probability of school dropout increases by 5.4 percent points to 8.0 percent for native Dutch students who were enrolled in primary schools with more than 77.7 percent non-western minority students and did not experience frequent school mobility.

Chapter 5 analyses the evolution of neighbourhood ethnic composition as a social interactive outcome of disaggregated household behaviour. ‘White flight’ or the departure of native or socially advantaged households from neighbourhoods is hypothesised to occur when minority share rises above some threshold. Did some segregated neighbourhoods in Dutch large cities ‘tip’ towards an all non-western minority composition? Using three metropolitan area samples in the Netherlands, Chapter 5 tests the potential ‘tipping points’ in neighbourhood ethnic composition, beyond which ‘white flight’ occurs. The results concur with evidence of ‘white flight’ in the form of a negative statistical association between decadal growth of native Dutch and western minority neighbourhood share and the initial share of non-western residents. However, neighbourhoods did not ‘tip’ towards hyper-segregated ethnic enclaves during the observation period. While some native Dutch and western minority households did flee or avoid neighbourhoods with non-western minority share beyond a certain threshold, this effect on neighbourhood segregation was limited. The chapter ends by suggesting the mediating effects of the country’s large social housing sector, centralised tax and redistributive regime, and strong regulatory role of the state in housing and urban planning.

Samenvatting

Het proefschrift begint met het beargumenteren van het nut van een West-Europese casestudy op het gebied van etnische segregatie en de integratie van migranten, aangezien de landen in deze regio worden geconfronteerd met een onbedoelde transformatie naar immigratielanden. In de laatste decennia zien we in West-Europa de opkomst van cruciale beleidsrichtlijnen op het gebied van buurt segregatie; bijvoorbeeld grootschalige stadsvernieuwing zoals uitgevoerd door de London Docklands Development Corporation in de 80'er jaren en het Europese URBAN programma in de 90'er jaren. Meer recentelijk zijn migratie en migrant gerelateerd beleid en onderzoek nationaal en internationaal tot bloei gekomen. Voorbeelden hiervan zijn het Haags Programma van de EU in 2004 ter ontwikkeling van gemeenschappelijke indicatoren voor migrant integratie, en het door de Europese Commissie gesponsorde onderzoeksconsortium International Migration, Integration and Social Cohesion in Europe (IMISCOE). Naast de behoefte aan zogenaamd evidence-based beleidsvorming, draagt de opkomende verzameling aan micro en ruimtelijke gegevens bij aan een rijke basis voor etnisch segregatie onderzoek in West Europa.

Eén van de manieren om de oorzaken en gevolgen van etnische segregatie te bestuderen is volgens de neoklassieke theorie. Deze theorie beschouwt mensen als rationele en nut maximaliserende individuen die beschikken over perfecte informatie waarmee hun voorkeuren binnen financiële beperkingen kunnen worden gerealiseerd. Voorkeuren zijn over het algemeen heterogeen, en in dit proefschrift gaan we er van uit dat etnische verschillen in persoonlijke voorkeur een oorzaak zijn van segregatie. De veronderstelling is dat huisvesting-, buurt-, en school attributen ongelijk zijn verdeeld. Om een compleet beeld te krijgen kan de neoklassieke theorie worden uitgebreid met sociaal interactieve effecten van voorkeur en externe beperkingen die keuzes en segregatie beïnvloeden. Aangezien de neoklassieke theorie grotendeels beperkt is tot Noord-Amerikaanse segregatie studies, kan een toepassing op West-Europa een integrale bijdrage leveren aan de literatuur. Een land zoals Nederland heeft een verschillende sociale dynamiek tussen de inheemse bevolking en migranten en een grote rol gelegen bij de verzorgingsstaat bij het bemiddelen bij sociale ongelijkheid en de markteffecten van voorkeuren per se. De voor de hand liggende vraag is of deze eigenschappen invloed hebben op segregatie in Nederland.

Dit proefschrift verdeelt het onderwerp van etnische segregatie in Nederland over drie dimensies -huisvesting, scholen, en buurten- en vier empirische hoofdstukken. In hoofdstuk 2 en 3 kijken we naar de oorzaken van segregatie in de vorm van heterogene voorkeuren, met de nadruk op de samenstelling van de groep soortgenoten. Hoofdstukken 4 en 5 verkennen de nonlineaire dynamiek in deze groep, en hoofdstuk 4 behandelt het effect van segregatie op de samenstelling van groepen op school.

Huisvesting, school en buurt kenmerken die gelijktijdig vorm geven aan woonomgeving en schoolkeuzes kunnen worden gezien als een verzameling kwaliteitsattributen. De hedonische-prijsmethode en discrete keuze modellen zijn twee dominante methodes voor het modelleren van keuzes en voorkeuren. De geschiktheid van elke methode hangt af van de product ruimte, oftewel als deze dicht bevolkt is met producten van verschillende niveaus van attribuut samenstelling (best geschikt voor hedonische-prijsmethode), of als het bestaat uit een beperkt aantal discrete alternatieven (in dit geval zijn discrete keuze modellen aan te raden). Hoofdstuk 2 en 3 bieden respectievelijk interessante toepassingen van beide methodes op de Nederlandse woningmarkt en de basisschool "markt". Hoofdstuk 2 gebruikt een hedonistisch-prijs kader om huisvestigingskeuze te ontleden in een verzameling unieke componenten gebaseerd op het nut wat ontleend wordt aan huisvesting en buurt, en maakt een inschatting van de bijbehorende impliciete prijzen. Hoofdstuk 3 gebruikt daarentegen een discreet keuze framework om het relatieve (gebrek aan) belang van elke school en school peer attributen bij het bepalen van de uiteindelijke schoolkeuze te modelleren. Hoofdstuk 2 gaat nader in op de voorkeuren voor huisvesting en de buurt onder huiseigenaren in Nederland. Hebben autochtone Nederlanders en niet-westerse minderheden verschillende voorkeuren voor de etnische samenstelling van hun buurt? Om die vraag te beantwoorden moet de onderzoeker zich bewust zijn van het feit dat huishoudens hun huisvestingkeuze niet puur laten hangen van één kenmerk, maar is het een afweging tussen meerdere karakteristieken met verschillende prioriteiten. Op basis van de grote steekproef voor Den Haag in het Nederlandse Woningmarkt onderzoek voorspellen de empirische data een gemiddelde daling van de woningprijs van 697 euro voor elke 10 procent toename van niet-westerse buurtgenoten, wanneer overige variabelen gelijk blijven. Hoewel de gemiddelde niet-westerse huiseigenaar onverschillig tegenover de etnische samenstelling van de buurt staat, zijn er blijkbaar toch een aantal die liever niet meer niet-westerse huishoudens in hun buurt willen. Dit is in essentie een test van de inburgeringstheorie in Nederland, dat wil zeggen of huiseigenaren van een niet-westerse allochtone achtergrond een negatieve bereidheid hebben om te betalen om naast meer co-etnische burens te wonen.

Hoofdstuk 3 evalueert de schoolkeuzes van voornamelijk niet-westerse studenten

na de gedwongen sluiting van drie zwarte scholen in Amsterdam. Het is gebaseerd op data over school inschrijvingen welke is gekoppeld aan data over de financiering van publieke scholen en medewerkersgegevens van het Ministerie van Onderwijs, Cultuur en Wetenschap. Hebben de studenten na de sluiting gekozen voor dezelfde school of hebben ze zich verspreid over verschillende scholen? Door rekening te houden met de mogelijke schoolkeuzes voor deze studenten kan dit hoofdstuk de relatieve voorkeur voor scholen met meer (of minder) groepsgenoten met dezelfde etnische en sociaal-economische achtergrond identificeren. Het hoofdstuk kijkt ook naar de waarschijnlijkheid dat ouders eerste prioriteit geven aan de keuze van het type school of de religieuze achtergrond voordat ze scholen selecteren van een bepaald type. Wanneer dit wordt verwerkt in de analyse vinden we dat een stijging van een procentpunt in het aantal niet-westerse soortgenoten de kans op school keuze verdubbelt naar 14 procent. Hoofdstuk 3 draagt bij aan beleidsvorming door het idee te toetsen dat (sommige) ouders scholen niet als gelijkwaardig beschouwen afhankelijk van het type of de religieuze achtergrond. In de toekomst zouden de beleidsinterventies ook een onderdeel moeten hebben, waarin de factoren die de schoolkeuze beïnvloeden, en de beschikbaarheid van gewenste alternatieven voor de scholen worden geïdentificeerd.

Hoofdstuk 4 onderzoekt de invloed van de etnische samenstelling en school mobiliteit op het basisschool niveau op de kans om vroegtijdig de middelbare school in Amsterdam te verlaten. Is de etnische samenstelling van een school van invloed op de kans om schoolverlater te worden? Aangezien schoolverlaterschap naar verwachting het gevolg is van cumulatieve factoren op de lange termijn, zou de ideale dataset al observaties bevatten vanaf een redelijk jonge leeftijd. In dit hoofdstuk gebruiken we unieke en beperkt toegankelijke administratieve data welke variabelen op basisschool niveau -zoals etniciteit en mobiliteit- aan het resultaat op de middelbaar school koppelt. Om de causaliteit vast te stellen is een discontinuïteit in de voorspelde kans op schoolverlaterschap met betrekking tot het aandeel niet-westerse klasgenoten vastgesteld en getest. De kans op schoolverlaterschap stijgt met 5,4 procentpunt naar 8,0 procent voor autochtone Nederlandse studenten die waren ingeschreven op basisscholen met meer dan 77,7 procent niet-westerse minderheden en die niet regelmatig van school veranderden.

Hoofdstuk 5 analyseert de ontwikkeling van de etnische samenstelling van een buurt als het sociaal-interactieve gevolg van uitgesplitst gedrag van huishoudens. "Witte vlucht", of het vertrek van inheemse of sociaal bevoorrechte huishoudens uit een buurt wordt verondersteld te gebeuren wanneer het aandeel minderheden boven een bepaalde drempel komt. Zijn sommige gesegregeerde buurten in grote Nederlandse steden doorgeslagen naar een samenstelling van enkel niet-westerse minderheden? Met behulp van data van drie metropolen in Nederland toetst dit hoofdstuk het potentiële omslagpunt in de etnische samenstelling van een buurt

om een "witte vlucht" te veroorzaken. De resultaten komen overeen met bewijs van "witte vlucht" in de vorm van een negatief statistisch verband tussen de groei per decennium van het deel autochtone Nederlanders en westerse minderheden, en het aanvankelijke aandeel van niet-westerse bewoners. Echter, buurten sloegen in de observatie periode niet door naar hyper-gesegregerde etnische enclaves. Hoewel sommige autochtone Nederlandse en westerse minderheden buurten met een bepaald aandeel niet-westerse minderheden ontvluchten of vermijden, was het effect op de algehele buurt segregatie beperkt. Het hoofdstuk eindigt met de suggestie dat de sociale woningbouw, gecentraliseerde belastingen en herverdeling, en een sterk regulerende rol van de overheid een bemiddelend effect hebben op woning- en stedenbouw.

Biography

Cheng Boon Ong (1983) grew up in Batu Gajah, Malaysia. She read Politics and International Relations at the University of Essex in England and graduated as the department's best undergraduate student in 2006. She received a full scholarship to pursue her Master's degree in Social Policy Analysis in Luxembourg and Belgium, graduating with great distinction from the Catholic University of Leuven in 2007. She also holds a Diploma in Economics from the London School of Economics and Political Science.

Keen to contribute to effective, equitable, and sustainable policymaking, Cheng began her PhD in Public Policy and Policy Analysis at Maastricht University in 2007. At the Maastricht Graduate School of Governance, she was also a Master programme specialisation coordinator (2008-2009) and project coordinator for a multinational training programme in social security funded by the International Development Agency of Germany (2009-2012). Alongside research and project coordination, she has teaching experience in public policy, social protection, research methods, and international politics. Notably, she has trained UNICEF officers in evidence-based policy making, developed econometrics assignments for public policy graduate students, co-designed a one-day course on migration for social protection professionals, and delivered a lecture on ethnic segregation in schools for the Diploma in Public Policy and Child Rights (Egypt and Jordan).

She is currently based in Bangkok, Thailand assisting the regional office of the International Labour Organisation in the social protection assessment of the Southeast Asian region.

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