SCHOOL CHOICE AND SEGREGATION: EXPLANATORY MODELS

Thomas Wouters & Steven Groenez

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School Choice and Segregation: Explanatory Models

Thomas Wouters and Steven Groenez

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Nederlandstalige beleidssamenvatting

Dit rapport is bedoeld als overzicht van (voornamelijk economische) literatuur over woon- en schoolse segregatie. In het eerste deel gaan we in op theoretische modellen die, in navolging van Schelling en Tiebout, de segregatiedynamiek formeel voorstellen. Deze sociale interactiemodellen verklaren de keuze voor een bepaalde buurt of school onder meer vanuit preferenties voor groepscompositie. In het tweede deel gaan we na in welke mate de assumpties uit de theoretische modellen empirisch bevestigd worden. We gaan dieper in op de manier waarop preferenties tot stand komen en beschouwen naast preferenties ook andere factoren en beperkingen die een rol spelen in het keuzeproces, zoals de rol van informatie en het schoolbeleid. We staan ook uitgebreid stil bij de mate van relevantie en toepasbaarheid van deze modellen in de context van het Nederlandstalige onderwijs.

Wat de theoretische modellen betreft, is de benadering vooral op preferenties voor buurt- of schoolkeuze gebaseerd, en dan voornamelijk op preferenties naar de samenstelling van buurten of scholen. Uit het Schelling model [45] blijkt bijvoorbeeld dat relatief zwakke preferenties voor samenleven met groepsgenoten voldoende zijn om een hoge mate van segregatie in stand te houden of een tipping-dynamiek op gang te brengen. Er bestaan grote verschillen in preferenties voor groepscompositie tussen etnische groepen, waarvan die tussen blank en zwart in de VS het meest uigebreid gedocumenteerd zijn. In het algemeen, echter, zijn deze verschillen bijna volledig terug te leiden tot verschillen in de socio-economische posities van deze groepen. Preferenties voor socio-economische status (SES) zijn dan weer veel homogener. Onafhankelijk van de eigen achtergrond verkiest men scholen (en buurten) met een hoger socio-economisch profiel. Des te sterker intelligentie en schoolprestaties correleren met SES, des te meer we verwachten dat deze preferenties sterker naar voor komen. Door schoolkeuzefactoren gedetailleerder in kaart te brengen, komt naar voor dat preferenties voor verschillende groepen meer op elkaar gelijken. Wanneer informatie over schoolkwaliteit eenvoudiger ter beschikking wordt gesteld, er

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rekening gehouden wordt met verschillen in residentiële keuzes en men enkel de keuzes die ouders effectief in overweging nemen modelleert, verkleinen de verschillen in schoolkeuzedeterminanten tussen SES-groepen. Desalniettemin toont de theorie aan dat kleine verschilllen in preferenties voldoende kunnen zijn voor segregatie. Dit verandert niet wanneer de meerderheid een geïntegreerde situatie verkiest boven sterke segregatie.

Ook met homogene preferenties voor buurt- en schoolsamenstelling is segregatie een plausibele uitkomst. Deze situatie komt dan tot stand als gevolg van mechanismen die de toegang tot scholen bepalen. Dergelijke mechanismen kunnen gerelateerd zijn aan inschrijvingsgeld, afstand tot de school, intelligentie, of een combinatie hiervan. Zelfs wanneer afstand tot de school geen expliciet criterium vormt, zullen transportkosten steeds een rol spelen en tot een spillover van woonsegregatie naar schoolse segregatie leiden. Gegeven de link tussen buurt- en schoolsamentelling komen we terecht in een evenwicht dat gekenmerkt wordt door prijsverschillen die op hun beurt verschillen in betalingsbereidheid weerspiegelen. Dit is het grootste verschil met de situatie waarin preferenties heterogeen zijn over de groepen, en waarin dus een evenwicht zonder prijzen tot stand kan komen. Met het afstandscriterium als mechanisme om schoolplaatsen toe te kennen moet aldus voorzichtig omgesprongen worden, bijvoorbeeld door het enkel aan te wenden om plaatsen *binnen* SES-groepen te alloceren (zoals het geval is in het systeem van dubbele contingentering).

Introduction

This report serves as a literature review of (mainly economic) models on school and neighbourhood choice. These models provide insight into the dynamics of segregation, the uneven distribution of students across schools. The text is divided into two parts. In the first part, economic models in the tradition of Schelling and Tiebout are discussed. They are called *social interaction models*, as the neighbourhood and school choices are explained from i.a. preferences for group composition (ethnic and/or socio-economic). In the second part, we look at the determinants of school choice, to understand to what extent the assumptions underlying the models from Part I are realistic. We dig deeper into the construction of preferences for group composition and we shortly review alternative explanations that not only consider preferences, but also take into account constraints, the role of information, and school policies. Finally, we emphasize the relevance of the literature in light of segregation in the Dutch-speaking education system.

Schools and neighbourhoods This report focuses on school segregation. How do students from different socio-economic backgrounds end up in other schools and how do large regional differences in school segregation come about? School segregation, especially in Kindergarten and primary education, is strongly

correlated to residential segregation[1]. Residential decisions determine distance to school, which is the most important determinant of school choice. Given that some parents also take into account (perceived) school quality and capacity when making housing decisions, the causality goes in both directions. Since the two phenomena are closely intertwined, it is unproblematic that the theories below are first and foremost theories that aim to explain residential segregation. Nevertheless, it might be interesting (especially for policymakers) to consider determinants of "pure school segregation", defined as the additional segregation that comes on top of residential segregation. This amount of "pure school segregation" can then take on negative values as well, if schools are less segregated than neighbourhoods.

One important difference between school and residential segregation is in prices. In a residential choice setting, prices bring about equilibrium and house prices can vary enormously between neighbourhoods. With respect to school choice, prices will only have minor effects (e.g. transport costs, school trips and material) in most countries and regions (such as Flanders). Differences in (in)direct costs between schools are insufficient to match supply and demand for available places.

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[1] For Flanders, evidence for this can be found in Wouters and Groenez [51] and Sierens et al. [48]

Part I
Social Interaction Models.
Exogenous preferences

According to Card et al [14], "[t]he key feature of these [social interaction] models is that preferences depend on other agents' choices". Take an agent's utility function $u \sim u\left(SC_1, SC_2, ..., SC_K\right)$, where the SC- terms are the schools' characteristics that parents take into account when choosing a school. Let SC_1 be the school's composition and SC_2 to SC_K be any other relevant choice criterium, such as teacher quality, proximity, buildings' quality, pedagogical approach etc. School composition is featured in the agent's utility function, but is itself the outcome of the choice process of all other agents. My utility depends on your choice. If I expect your child to have a positive influence on my child, you choosing school A will increase the likelihood of me doing the same. In this part, I will review the characteristics and segregation dynamics of social interaction models of two kinds: tipping point models (Schelling [45]) and market models (in the tradition of Tiebout [50]). Schelling considers one neighbourhood and explains segregation through a preference for one's own group. The other models we consider are more in the Tiebout tradition: agents choose a location based on the bundle of public goods and taxes this choice implies. The Tiebout model stresses that one's residential location is not a given. Rational agents compare differences in neighbourhoods and pick the one that suits their preferences best. In such contexts, it makes little sense to look at school segregation as an isolated phenomenon. We thus explore the theoretical links between neighbourhood and school segregation. Furthermore, we will show that preference heterogeneity (i.e. preferences that differ across groups) is not a necessary condition to bring segregation about.

At the end of this part, we shortly consider a model where the interaction of these two main dynamics (a preference for one's own group combined with a shared preference for one particular group) makes the picture more complex.

1 Schelling, own-group preferences and tipping points

Schelling [45] starts from a number of weak assumptions about people's preferences for their immediate neighbours and shows how these preferences interact to create collective results as residential segregation. He models agents as belonging to an ethnic group and assumes a distribution about the maximum proportion of neighbours from the other ethnic group they can stand. This distribution is assumed to be uniform. The least tolerant individual only wants to live among people from her own group. The most tolerant individual does not mind being the only one of his type in a neighbourhood, as long as the number

of people from the other type is not too high. The most striking result is that individual preferences with respect to segregation at the macro level seem to have little influence on the collective result.

Schelling specifies two models: the spatial proximity model and the bounded-neighbourhood model. In the spatial proximity model, neighbourhoods are defined as the collection of immediate neighbours. As a result, each individual has her own idiosyncratic neighbourhood to which she applies her tolerance level in order to decide whether she still wants to live there. In the second model, Schelling defines neighbourhoods differently. Instead of looking at one's immediate neighbours, a fixed geographic area is taken as a neighbourhood, and people only care about the relative presence of their own type within the neighbourhood.

1.1 Spatial proximity model

In this model, Schelling considers people's preferences with respect to their immediate neighbours. He then looks at the dynamics of segregation within the larger area. Most of the time this area end up being completely segregated, although individuals do not prefer complete segregation. Generalizations and robustness checks of this model show that even when agents strictly prefer integration to segregation, we still end up with segregation (Pancs and Vriend [41] and Zhang [52]).

In a residential segregation setting, this model may be appropriate. People on the boundary of a neighbourhood may care as much about the composition of adjacent neighbourhoods as about their own neighbourhood's composition. In the context of school choice, however, these individual-specific definitions of neighbourhoods (output-categories) seem less interesting. A school's "boundaries" are supposed to be the same for everyone. Everyone attending a certain school considers everyone else attending this school as her neighbours. We therefore turn to a second type of model, the bounded-neighbourhood model.

1.2 Bounded-neighbourhood model

In his second model, Schelling defines neighbourhoods differently. Instead of only looking at one's immediate neighbours, a fixed area is defined as a neighbourhood, and people only care about the ratio of their own type within the neighbourhood. This approach is more similar to the Becker model of neighbourhood segregation (cfr section 2.1). But as opposed to Becker, Schelling uses distributions of tolerance levels towards people from another type instead of assuming that preferences across types are the same. The biggest difference with Becker, however, is that segregation dynamics are not modelled as the outcome of a market process, but as the interaction between groups' tolerance levels and distributions.

Concretely, it becomes possible to explain relatively extreme and short-run changes in segregation: in a neighbourhood that is originally dominated by type W people, a dynamic of tipping can be started where the composition of the

neighbourhood may completely turn around as a result. This starts when the least tolerant individual from type W moves out of the neighbourhood because the amount of type B people has become too high. While the ratio of B to W people has increased, the ratio of W to B people has decreased, resulting in an even larger outflow of type W people. This process goes on until all individuals from type W have left. The resulting situation is one of complete segregation.

Figures 1 and 2 are both taken from Schelling's original paper and show the above logic graphically. The reaction curves represent the tolerance levels for the two groups: W (whites) and B (blacks). One's tolerance level is understood as the minimal proportion of members from one's own group one is comfortable with. For example, someone who only considers neighbourhoods where ate least 25% of the population is made up of people from her own type has a tolerance level of 75%. The reaction curve of group W (i.e. the tolerance of whites towards blacks), for instance, starts at the origin. The most tolerant individual is situated on the left of the W axis. She has the highest ratio of group B relative to group W people. Given that she is the most tolerant person and thus the first to move into the neighbourhood (or the last one to leave), the absolute number of type B people she wants to live with is her ratio (Schelling proposes a value of around 2) multiplied by 1. The second most tolerant individual will have a lower ratio, but since the number of group W people will be 2 when he moves in (individual 1 is already there), this translates into an absolute number that is higher than 2, but less than 4. As a result, the reaction curve is concave and will cross the horizontal axis again at a certain point (here at W=100), where the ratio of the least tolerant individual is 0. She will be the first one to leave and the last one to move in.

Being below the segregation curve of any of the types will cause more individuals from that type to move in, while being above it will cause individuals to move out of the neighbourhood. These dynamics are represented by the little arrows in Figure 1. The triangle at (25W, 25B) lies below the W curve and on the B curve. In such a situation, no black individual is tempted to move in or out of the neighbourhood. The most tolerant white will move in since her tolerance ratio is higher than the current 1 to 1 ratio. With 25 members of her own group living in the neighbourhood, she would be comfortable having around 35 members of other groups living in the neighbourhood (cfr the dashed lines in figure 1). The other triangle, at (75W, 25B) lies below the W curve again, but above the B curve. Blacks will move out and whites will move in. The neighbourhood is one its way to become fully segregated at point (100W, 0B). The only area on the graph where both type W and type B people are happy to continue moving in is the overlapping area between the two curves. The only stable equilibria, however, are the two cornerpoints that reflect situations of perfect segregation. The red dot symbolizes an unstable equilibrium. The smallest deviation from it will eventually push the neighbourhood towards one of the two points of complete segregation.

Figure 1: Schelling model with tolerance level towards the other group (no stable equilibrium)
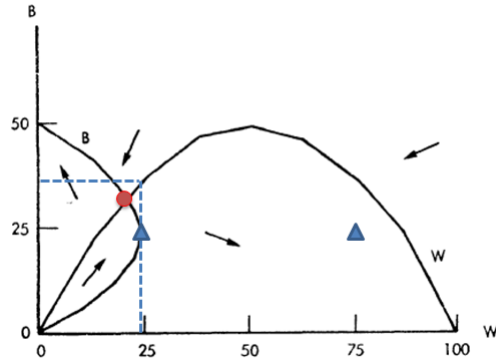

Figure 2 shows that a stable equilibrium (indicated by the red dot) is possible as well. The dynamics of movement around this point ensure that any deviation from it will be restored immediately. In that situation (80W, 80B), both blacks and whites are on their reaction curves. For both groups, it holds that the most tolerant individual that has not yet moved into the neighbourhood prefers to stay out. This individual is less tolerant than the least tolerant one inside the neighbourhood, for whom a tolerance ratio of 1 to 1 was still acceptable. As a result of the reaction curves' slopes being negative, the improvement in the tolerance ratio that would occur when the most tolerant outsider moves in is not sufficient to make her consider doing this.

Figure 2: Schelling model with tolerance level towards the other group (stable equilibrium)
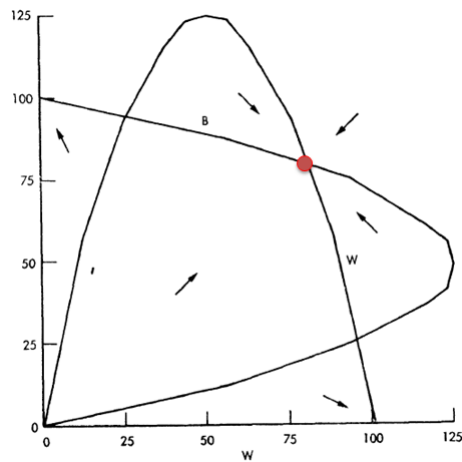
Clark [17] constructs similar graphs, but on the basis of actual data from phone interviews. He finds that graphs as in the first situation are much more prevalent. Integrated, stable equilibria are thus rare.

1.2.1 Tipping behaviour

The bounded-neighbourhood model allows for an easy way to represent tipping behaviour, where neighbourhoods become completely segregated once a certain *tipping point* has been reached. In fact, we can already see this from Figure 1: as long as the neighbourhood stays in the situation represented by the red dot, nobody has an incentive to move away. Once new whites or blacks arrive, the compositions tilts in favour of either of these two groups. A more convincing graphical representation, where the initial situation is inherently more stable, can be found in Figure 3. The diagonal line now represents neighbourhood capacity. In the left panel, blacks will start to move in as soon as houses become available. As long as the neighbourhood composition stays below the white's reaction curve, no one living in the neighbourhood has an incentive to leave. Once this is no longer the case, a snowball effect arises with the neighbourhood turning completely black in a short period of time. The difference with the right panel is that blacks will not start moving in immediately if the initial situation is one where all houses are occupied by whites. Once a significant amount acquire houses in a concerted way, the analysis from the left panel applies here too.

Figure 3: Schelling model with tipping
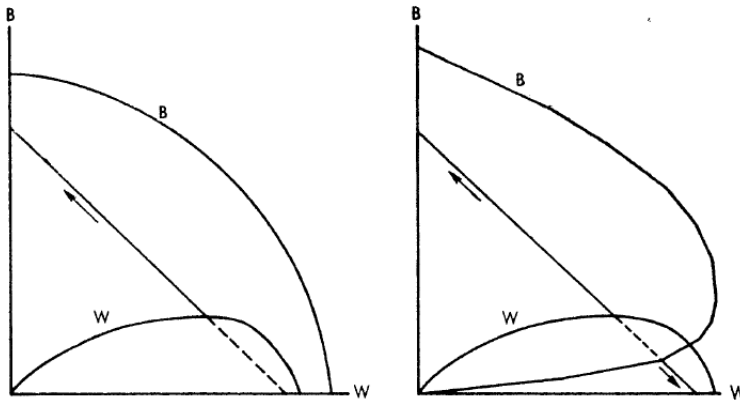
An empirical test of the tipping dynamic itself was conducted by Card, Mas and Rothstein [14]. In Figure 4 below, taken from their paper, the change in a

neighbourhood's proportion of whites (i.e. the absolute increase in the number of whites between 1970 and 1980 divided by the total neighbourhood population in 1970) is plotted against the neighbourhood's initial proportion of non-whites. According to Schelling's tipping point theory, we expect neighbourhoods below a certain initial threshold (here somewhere between 5 and 15 per cent of non-whites) to attract whites in the following years, while we would expect neighbourhoods with a higher proportion of non-whites to see their share of whites shrink in the years following this observation. Card, Mas and Rothstein [14] find some evidence for this logic (Figure 4). Every observation (dot) represents a neighbourhood in Chicago. The figure makes clear that neighbourhoods with a small minority share in 1970 experienced a subsequent inflow of individuals from the majority group. Neighbourhoods with somewhat larger shares of the minority population experienced serious outflows by majority group individuals. The reason why this outflow is stronger in the middle of the graph than at the extreme is a bottom effect: in neighbourhoods with a more that 80% "minority share", the maximal amount of majority group people that can have emigrated after 10 years is at most 20% of the original neighbourhood population size. From the figure and the rest of their paper, it can be inferred that an original minority share of somewhere between 5 and 10% of the neighbourhood population will be enough to set in motion a dynamic of tipping that can turn the neighbourhood into a situation of complete ethnic segregation.

We can conduct a similar exercise on Flemish data[2]. Figure 5 considers changes in school composition for high and low socio-economic status (SES) students between 2001 and 2010 in Kindergarten schools in the Flemish province of Antwerp. Each observation (dot) now represents a school. The variable on the vertical axis differs slightly; it now represents the percentage-point increase in high SES students between 2001 and 2010. We are not only interested in how high SES students react to the presence of low SES students, but also the other way around. The variable on the horizontal axis still represents the percentage share of low SES students in each school. The diagonal lines demarcate the area in which observations can lie. The lower line is the floor: it is not possible for the proportion of high SES students to decrease by more than its initial proportion. For instance, a school with an initial 60% low SES students (or, equivalently, 40% high SES students) cannot see its proportion of high SES students decrease by more than 40 percentage points. The other line represents the ceiling. Taking the same example, it is not possible for this school to increase its proportion of high SES students by more than 60 percentage points. The pattern as observed in Figure 4 is largely absent. Whether a school had a relatively advantaged composition or a relatively disadvantaged composition seems to have very little impact on the change in its student body over the subsequent

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[2]We make use of a dataset by the department of education of the Flemish government. The dataset contains over 13 million observations on students in Kindergarten, primary, and secondary school. Each observation is a record of an individual student in a specific school year. The dataset contains population data, with observations on each student in the education system (excluding tertiary education) for school years 2001-2002 until 2011-2012 (2010-2011 for Kindergarten schools).

10 years. Only with the most disadvantaged schools, a partial indication for tipping can be observed (very few schools can be found in the circled area in figure 5). Schools with an initial composition of over 80% low SES students have a very low probability of taking on a more "advantaged" profile. We do not observe this dynamic in all regions, and never for the most advantaged schools.

Apart from the different way we plot the data (Card et al look at movements of whites, neglecting movements of non-Whites and Hispanics), one of the reasons for the different pattern we find might be that we consider a different kind of segregation, i.e. socio-economic segregation versus ethnic segregation. It is very likely that with socio-economic segregation in Flanders today, people's attitudes towards other groups take on a different structure than with racial segregation in the 1970s in the United States.

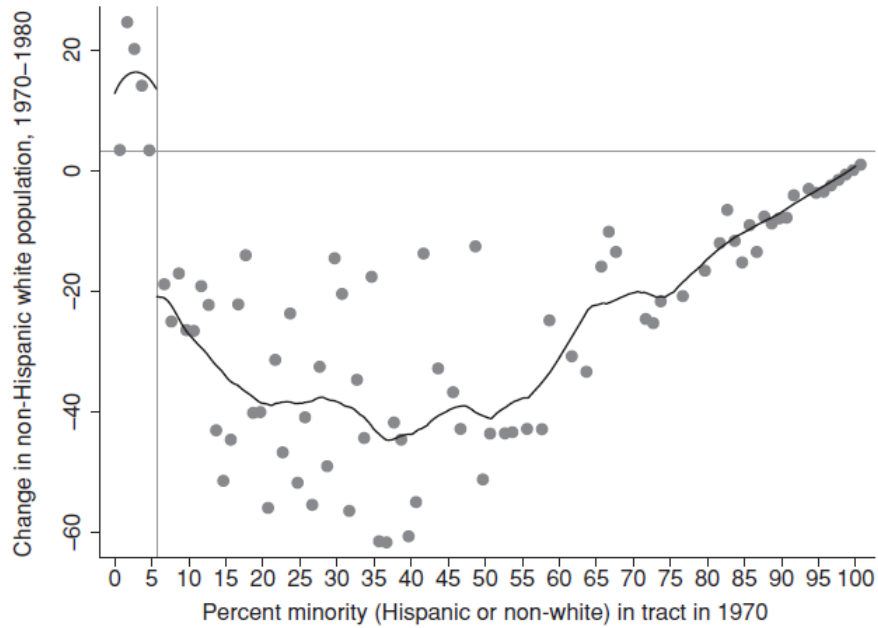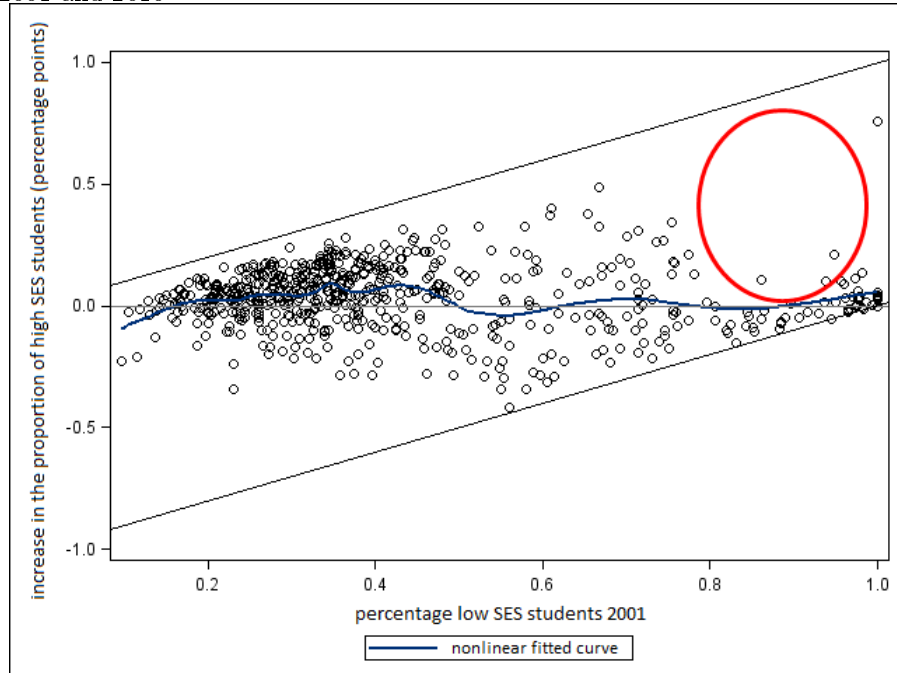Figuur 4: Tipping (uit Card et al [14])

Figuur 5: Tipping in the province of Antwerp, Kindergarten schools between 2001 and 2010

The biggest difference with the models from the next section is that Schelling does not model segregation dynamics as the outcome of a market process, but as the interaction between groups' tolerance levels and shares of the population. In a market model, equilibrium implies that all markets have cleared. An equilibrium in one neighbourhood is only possible when the other neighbourhood is in equilibrium as well. This is not the case in the Schelling's bounded neighbourhood model, which is not closed. It is not clear what happens to the people that leave the neighbourhood, or where potential inhabitants reside before entering it. In the spatial proximity model, everyone is included from the beginning and then moves until an equilibrium is reached. In the bounded neighbourhood model, however, the equilibrium will not involve everyone. This is a reasonable assumption in some "voluntary" settings (e.g. membership in youth movements, or in any kind of religious, cultural of sports organizations). When schooling is mandatory (or quasi-mandatory as in the Flemish education system), an equilibrium will have to involve everyone, not just one school or neighbourhood.

2 Market models

The models in this section stand in the tradition of Charles Tiebout's [50] seminal work on the provision of local public goods. In one community with public goods, it is very difficult to aggregate preferences as everyone has an incentive to downplay his preferences for the public good. The level of provision will be inefficient. Tiebout asserted that under a set of conditions (i.a. high mobility and a large number of communities) people would vote with their feet (i.e. migrate) and sort into communities with levels of public goods that suited their preferences well. An equilibrium with efficient provision of local public goods then becomes possible. Although our main interest does not go out to the efficiency aspect of public goods provision, the main idea we take away from the Tiebout model is that of households optimizing their decision about which neighbourhood to live in. In doing so, they take into account all relevant aspects of living somewhere, including the level of public education. As a result, a natural link between neighbourhood and school segregation emerges. Households will keep switching neighbourhoods or communities until an equilibrium is reached. Our goal lies in the characterization of such equilibria in terms of socio-economic segregation.

2.1 Becker, Murphy: "Market Behavior in a Social Environment"

Becker and Murphy [6] start their book from the assumption, commonly made in economics, that the presence of others only indirectly influences one's behaviour, through changes in relative prices. The book wants to incorporate social forces in the framework of the rational economic man. Instead of assuming that members from each group prefer to live in each other's presence, as Schelling does (see Section 1), Becker proposes a model in which one type of people is preferred as neighbours by all. This parallels his approach to the "marriage market", in which society agrees on a complete ranking of individuals. Becker starts from a simple setup in which residents choose to live in one of two neighbourhoods that are identical in every dimension except for the presence of the preferred type (type H). In such a situation, the equilibrium in a competitive housing market has a price differential, with houses in the neighbourhood with the highest ratio of type H people selling at the highest prices. This price differential reflects a difference in willingness to pay between the two neighbourhoods, which is equal for both types of people in equilibrium.

Figure 6 shows this graphically. The share of the preferred type of people in neighbourhood a (s_a) is depicted on the horizontal axis, while the price differential is given on the vertical axis. Here, $s_a = 1/2$ corresponds to perfect integration (both groups are of equal size), and $s_a = 1$ to perfect segregation. In order for an equilibrium to exist where both groups are represented in each neighbourhood, the two curves need to cross as in Figure 6. This implies that, in the case where type H individuals make up the preferred group, the willingness to pay for housing in a neighbourhood with $s_a > s_a^*$ should be higher for type L

than for type H and vice versa. Especially when H and L stand for high and low socioeconomic status (as in this paper), this is a highly unrealistic assumption.

Figure 6: Becker model (stable equilibrium)
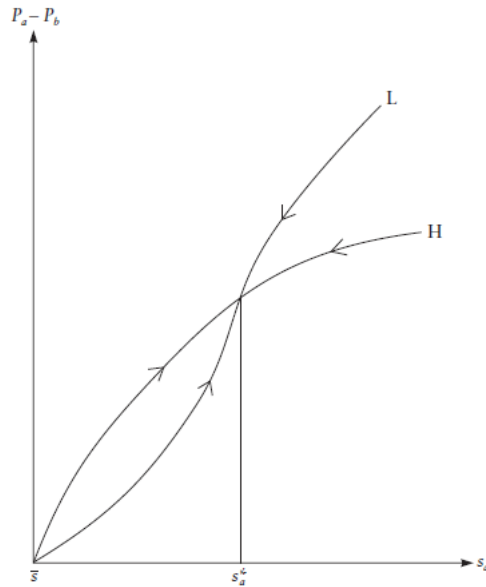
Becker goes on to show that when differences in amenities between neighbourhoods are introduced, very high degrees of segregation can occur even when differences in willingness to pay for these amenities between the two types of people are very small and when willingness to pay for neighbourhood composition is the same for both groups. Figure 7 shows graphically that although the willingness to pay functions lie very close to each other, the price differential between the two neighbourhoods will be large and the only equilibrium will be the one of complete segregation. Preferences for group composition are exactly the same across groups, from which it is tempting to infer that the price differential has nothing to do with group composition but should be explained by other dimensions of people's preferences. This is misleading, however, since the largest part of the price differential can be explained by the fact that people prefer to have H neighbours. This effect is called the social multiplier: "aggregate relationships overstate individual elasticities" [25]. In other words: even when the reaction of a single individual to an increase in school or neighbourhood quality is very small, this may lead to changes in neighbourhood composition that can trigger additional incentives for other agents to move in or out. The aggregate effect on prices, incorporating the social multiplier, may be much larger

than the price change one would predict on the basis of individual elasticities or preferences for school or neighbourhood quality.

Figure 7: Becker model (no stable equilibrium)
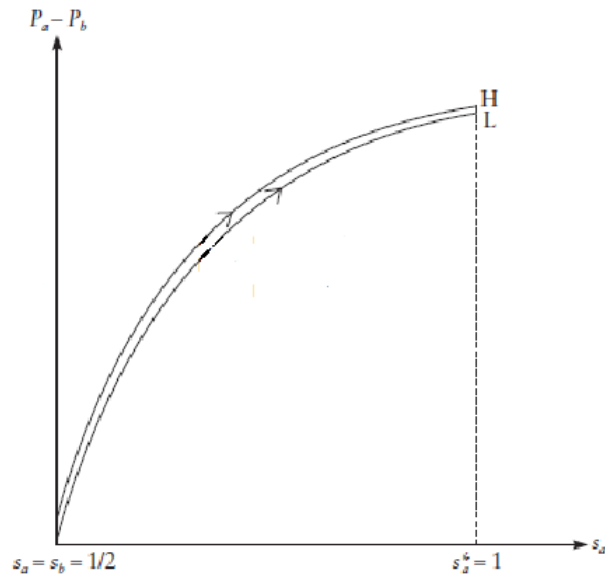
2.2 General equilibrium models

General equilibrium models on segregation consider both residential and school segregation (and often even political choices, such as voting over spending on public education). We can test to what extent housing and schooling decisions are taken simultaneously (see Section 4.2 below). The literature is often concerned with the effects of policy changes related to school financing (and thus tax policies) on residential segregation. The general equilibrium approach can provide insight into the high degree of income (or socio-economic) segregation between public schools (where no tuition has to be paid). The naïve interpretation would be that schools simply reflect the neighbourhood composition between schools. However, when schools differ in quality (and especially when these differences are related to differences in school composition), parental choices cannot be explained without further restrictions on choice.

First and second order segregation   We introduce the concepts first and second order segregation. The former is school or neighbourhood segregation analyzed in a partial equilibrium setting (i.e. only involving one "market"). Second order segregation results from interactions between the housing and education (quasi-) markets. It is analyzed in a general equilibrium framework, where all markets need to be in equilibrium. If housing and schooling decisions are not assumed to be made in a completely independent way, a general equilibrium framework is more appropriate. Figure 8 lists some conditions that are individually sufficient for neighbourhood or school segregation. In order to end up with neighbourhoods characterized by income segregation in equilibrium, one needs either differences in residential quality (and the accompanying differences in willingness to pay for them) or a sensitivity for neighbourhood composition. This sensitivity appears as heterogeneous neighbourhood preferences in the Schelling model or as homogeneous neighbourhood preferences combined with differences in willingness to pay (stemming from income differences between the two groups) in the Becker model.

The same categories can be used to characterize sufficient conditions for school segregation, taken on itself in a partial equilibrium setting. The first possibility consists of differences in (private) school quality and willingness to pay. We do not consider social interactions here; school quality is thus fully determined by infrastructure, teachers, or other factors that cannot be classified as peer effects. In such a setting, buying a house or buying one's way into a school are entirely analogous. When peers matter, and this is the perspective we take in the remainder of this text, a Schelling-type segregated equilibrium without prices is again possible. Things get more interesting when, on top of the peer effects, preferences are homogeneous across groups. A Becker-type equilibrium with segregated private schools is possible when the best peers also belong to the high SES type. With public schools or in the absence of a correlation between ability and income, a mechanism is needed to ration access to schools, such as cream skimming or tracking.

To summarize: segregation with heterogeneous preferences for one's peers

comes about easily. No prices are involved since the groups prefer different outcomes. With homogeneous preferences, we obtain conflicts over scarce resources. Prices or another mechanism to allocate students to schools is then needed to arrive in an equilibrium. This logic remains the same in the following, where we consider interactions between housing and schooling decisions (characterizing *second order segregation*).

Figure 8: First order segregation

Sufficient conditions for first order neighbourhood segregation:
- Differences in residential quality and willingness to pay

- Preference for own-group neighbours (Schelling model)

- Homogeneous preferences (across groups) for a certain neighbour type and differences in willingess to pay (Becker model)

Sufficient conditions for first order school segregation:

- Differences in school quality and willingness to pay (private schools)

- Preference for own-group peers (Schelling model)

- Homogeneous preferences (across groups) for a certain type of peers, combined with cream skimming or tracking

Literature on school financing This section heavily draws from Thomas Nechyba's chapter [38] "Income and peer quality sorting in public and private schools" in The Handbook of the Economics of Education. Following Nechyba, we consider three ways of sorting (i.e. ways through which segregation comes about): sorting between public schools, sorting between public and private schools, and sorting within public schools (tracking/streaming). Since the literature is mostly Anglo-American, private schools are understood as schools that are free to charge tuition and to decide on the mechanism to select students. This is not the sense in which the terms "free" or private schools are used in Flanders. Insights from the models we discuss below can nevertheless be applied to the Flemish context as well. This is discussed at the end of this section. Furthermore, the distribution of child ability and incomes across families is given and a positive correlation between the two is assumed[3]. We also assume that peer quality matters in the realization of individual educational outcomes (i.e. peer effects are real)[4].

A. Segregation between public schools We first turn to segregation between public schools. In a multiple district setting where people vote over

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[3]This could be because high SES students are smarter on average, resulting from the genetic component in intelligence, or because they receive stronger parental support at home.

[4]One reason could be a simple and direct spillover effect, where better peers provide help to other students and do not slow down the teaching process.

school financing policies at the district level and entry into the local public school is tied to one's district of residence (e.g. Nechyba [36], [37]), sorting can be a consequence of the way public goods (such as public education) are financed. Tax rates will be lower in the richest districts, although spending on the local public good will still be higher. House prices then not only reflect differences in housing quality, but also differences in school quality. Income segregation thus comes about between districts (rich people can afford higher housing prices to get access to the best schools), but also between neighbourhoods within the same district (where the richest people within a given district can afford to pay more for better quality housing). Remark that even when financial resources were equally distributed across districts, segregation between schools (and districts, since each district only has one public school) would come about. This would result from the positive correlation between child ability and parental income and the role of peer quality in determining school quality. Again, parents will prefer to live in rich districts, which only the rich can afford to do.

In the above logic, segregation is the result of local differences in school financing or a preference for high quality peers. Of course, some mechanism is needed to ration access to schools. In the absence of any constraint, people would keep changing schools until no differences in quality remain. In that case, the model would only predict residential segregation to the extent that housing quality differs between neighbourhoods. Leaving out the school financing dimension, Epple and Romano [23] consider a single district setting with two mechanisms to restrict access to schools, both based on place of residence. Schools can give priority to those living nearby, or transport costs can be modeled explicitly. School quality is again determined by the quality of the students. The conclusions from this model strongly resemble those from Nechyba. If access to schools is based on place of residence, house prices will differ between neighbourhoods and the neighbourhoods with the highest house prices will also have the best schools. This follows from the correlation between ability and income. If furthermore demand for quality of schooling increases with ability, the equilibrium is characterized not only by income segregation, but also by ability segregation (a result that also holds in the absence of a correlation between ability and income). Figure 9 shows income segregation for neighbourhood schooling, where demand for school quality does not increase with ability. Yet the quality of schools in neighbourhood 3 will be higher than in neighbourhood 1 and 2 as richer parents are more likely to have gifted children. If we do allow for the demand for school quality to vary with ability, the horizontal lines will turn into diagonal ones. If school choice is free and does not depend on neighbourhood residence, price differences between neighbourhoods would vanish (the model assumes no differences in housing quality) as well as quality differences between schools. This is only the case when transport costs are zero or not borne by the household. These costs can, however, also be modeled more explicitly. With very high transport costs (i.e. higher than the difference in housing prices that arises in the neighbourhood schooling equilibrium), all students choose their neighbourhood school and the equilibrium is again as in Figure 9. With transport costs at a more realistic lower level, an internal equi-

librium can come about in which the difference between housing prices in the richer and the poorer neighbourhood is exactly equal to the transport cost. If it were higher, people from the richer neighbourhood would want to migrate towards the poorer neighbourhood, thereby restoring equilibrium price levels.

Figure 9: Equilibrium with neighbourhood schooling (from Epple and Romano [23])
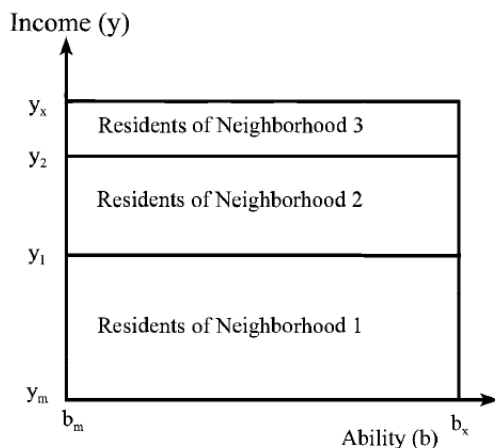
The segregation logic, where one group is preferred by all, is similar to the one found in Becker and Murphy [6], although there are no peer effects in the housing market. But given that housing and schooling constitute a bundled choice, "peer effects" in schooling lead to the same effect in the housing market as in the Becker model.

B. Competition and segregation between public and private schools
To understand segregation between public and private schools, we first shed some light on the competition these two type of schools are engaged in. For private schools, confronting parents with higher direct (tuition) costs than public schools, a competitive advantage over public schools is necessary. This can come in the form of above average peer quality (cream skimming) or a different production technology/function. The latter advantage may be the result of greater efficiency in private schools (possibly linked to rent seeking, i.e. the exploitation of a dominant position in the market for education, by public schools) or of other curricula to better respond to a diverse demand for education. Nechyba [38] proposes a basic way of modelling cream skimming, in which private schools set minimum ability and tuition levels, leading to perfect segregation in both income and ability. In a more standard cream-skimming model, Epple and Romano [22] put less restrictions on private schools and allow for price differentia-

tion. This leads to a stratified equilibrium characterized by cross-subsidization in which less able students cover the tuition costs of their more able peers. Another advantage that private schools may exploit in their competition with public schools lies in the "unbundling" of housing and schooling choices. When public schools recruit locally, resulting in the best public schools being located in the richest jurisdictions, private schools can locate in poorer areas and charge higher tuition (i.e. direct cost), effectively "replacing" the high indirect prices (i.e. high housing prices) "charged" by the best public schools.

C. Segregation within public schools: tracking Continuing in the logic of competition for students between public and private schools, a third kind of sorting, within public schools, appears. Tracking or streaming is represented as a way in which public schools can compete for the best students with private schools. Although not exactly the same, tracking is often used interchangably with streaming or ability grouping in the economics literature. The latter two concepts are actually less definitive ways of grouping students. With streaming or ability grouping, students are sorted by ability, but groups can differ per subject and students may change groups when this is considered appropriate. With tracking, strictu sensu, students usually make choices that are difficult to reverse, and have much less contact with students from other tracks.

Epple, Newlon and Romano [21] construct a single district model in which public schools are open to all and private schools can observe ability on which entry can be conditioned. They can also differentiate tuition and prices between students. As mentioned in Nechyba [38], tracking is used as an instrument by public schools to compete with private schools. These private schools have little incentive to track since they can already control their student inflow. More able students are more likely to choose a public school, given that they would be placed in one of the higher tracks. Less able but wealthy students are more likely to buy their way to a better group composition by attending a private school. This is consistent with the empirical observation of higher average income in higher tracks, which we would even expect in the absence of a correlation between income and ability.

In the baseline model (no tracking), which is the same as in Epple and Romano [22], students are stratified by income (since demand for educational quality is normal) (see Figure 10). There will also be some stratification by ability, as a strict hierarchy in school qualities will exist in equilibrium. On average, better schools will have higher ability students. Nevertheless, unless some additional conditions are imposed (namely that demand for quality is not decreasing with ability and that lower quality schools do not give higher discounts to ability), pure stratification by ability[5] does not necessarily arise.

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[5] Pure stratification by ability means that for a given income level, students attending a higher quality school have a higher ability level. Pure stratification by income can be defined analogously. For a given ability level, students attending a higher quality school come from higher income households.

Figure 10: Equilibrium without tracking (from Epple and Romano [21])
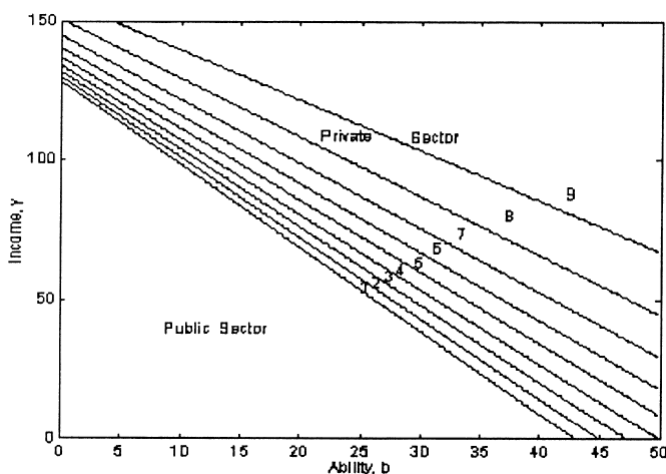
Figure 11 depicts the situation where tracking is introduced in the model. Private schools will not track as they do not have an incentive to do so. Without tracking, they can already set a minimum ability level and engage in price discrimination. Public schools however, use tracking to attract more able students, who would otherwise attend private schools. Not surprisingly, schools will still differ in average ability and income levels. Stratification by income still follows from the normality of demand for educational quality. Segregation by income, on the other hand, may well go down since the high track attracts students on the basis of ability foremost. The higher the ability threshold[6] for the high track, the more likely students from all income levels will be equally represented in the high track. The lower the ability threshold, the higher the incentive for the high income - high ability students to pick a private schools with a higher average quality (remember that higher income families have a higher willingness to pay for educational quality). Pure stratification by ability only holds under the above mentioned conditions. This is because the most able poor students may attend private schools of lower quality, where they are compensated with negative tuition levels. On the other hand, segregation by ability is likely to increase given that the upper track in the public school does not subsidize high ability - low income students through high tuition for low ability - high income students and as such targets a smaller range of students in the ability space as compared to private schools.

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[6]The ability threshold is not endogenous in the model. In principle, it could be endognised, but then an objective function for the public sector would need to be specified, as remarked by Nechyba [38].

Figure 11: Equilibrium with public school tracking (from Epple and Romano [21])

We now temporarily focus on the market for education only. Checchi and Flabbi [15] provide two very simple models of school tracking. In the baseline scenario, ability is perfectly observed and tracking is efficient. In the second scenario, only parental education is observed, which is positively correlated with (unobserved) ability. The lower this correlation, the greater the mismatch when sorting happens on the basis of family background. The models are too basic, but they provide some intuition. In a more realistic scenario, one could imagine ability to be partly observable (through tests), with parental education/ability also revealing some additional information about the student's ability. This means parents would have two indicators revealing whether their children's skills would be maximized in the academic or rather in the vocational track. These two indicators are both noisy signals of true ability, and the rational decision-maker would always consider both signals. For children performing just below the ability threshold on the test, high parental ability could then indicate that it is more likely for the child's true ability to lie above rather than below the threshold. Sorting would be more efficient than with only one (noisy) signal, i.e. the test. But the correlation between track choice and parental background would also be higher. Children that are mismatched with the vocational track are more likely to have low ability parents, while children mismatched with the academic track are more likely to have high ability parents. Segregation between tracks will then be higher than in the scenario with perfectly observable ability.

Brunello and Checchi [10] are mainly concerned with equality of opportunity and the effect of tracking on individual human capital accumulation. In the appendix to their paper, they propose two models to evaluate the effect of

21

tracking. In the first, simple model, two ability types exist. Nature determines whether you are endowed with high or low ability. Tracking is based on ability, which can be perfectly observed. Obviously, one gets stratification by ability. In the second model, tracking happens on the basis of talent, which is itself a function of (exogenously determined) idiosyncratic ability and parental background. The higher the impact of parental background on "talent", the higher the level of segregation by socio-economic characteristics. Now, we also get stratification by parental background. In these two models, the conclusions about stratification are embedded in the assumptions.

Model relevance in the Flemish context   The main message that emerges from this literature is that housing and schooling decisions may be intertwined. Arguably, with low transport costs[7] and open enrollment, this is less prevalent in the Flemish primary and secondary school system. However, more and more exceptions are being placed on open enrollment. In the three biggest cities with Dutch-speaking schools (Antwerp, Ghent and Brussels) and in more and more other communes and LOPs[8], pupils living closer to school are more likely to obtain a place. In the presence of discriminatory practices by schools or when information is more easily accessible by high SES groups, these policies are expected to lead to a better match between neighbourhood composition and school composition, and to a decrease in school segregation in the short run. With respect to long-run effects, policymakers should be aware that people will take such regulation into account when making housing decisions. To the extent people do this, and they think (as in the models above) that schools with higher SES compositions are more desirable, school and neighbourhood segregation may well be higher in the long run. Since in practice other parameters apart from distance to school are used to match students and schools, the risk that neighbourhood segregation would increase substantially in these places seems low. We elaborate on this at the end of section 4.3, where we review empirical studies on the link between school and neighbourhood choice.

Given the very low number of true private schools in the Flemish context[9], the argument about competition between public and private schools may be less relevant to explain segregation in the Flemish context. Tracking, however, is applied in secondary schools (de jure from the age of 14, de facto from the age of 12). The models discussed in part C above, however, mostly concern tracking in the context of competition from private schools. Leaving out private schools from the analysis, the picture becomes very simple: everyone above the ability threshold is in the upper track, the rest of the students are in the lower track.

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[7]Although direct transport costs (e.g. the price of public transport or driving one's bike) are low, indirect costs may be significant. Especially for young children, who need to be brought to and from school twice a day, the opportunity cost of providing transport will be important. For secondary schools, this argument holds less weight.

[8]LOP is the Dutch acronym for "lokaal overlegplatform". LOPs are similar to Local Educational Authorities in the UK, but have less decision making power. They usually encompass several communities.

[9]There are not more than a couple of dozen European, international of private schools in Flanders and Brussels. The number of students in private schools is below 10 000 [7].

In case we have more than one public school, the other public schools would have an incentive to track as well. If they did not, they would only attract students below the ability threshold. Why then, would no private school decide to enter the market for education? A first reason could be that the distribution of income is compressed. If the richest students that fall just below the ability threshold are only slightly richer than average, they might not be willing to incur the cost of private education. This interacts with a second element, which is the importance of educational outcomes for further educational or professional achievement, as perceived by parents. When university entry requirements, for instance, are not strongly linked to secondary school results, willingness to pay for private education would again be lower. Lastly, tracking as described here assumes perfect observability of talent and the use of tests to decide which track one qualifies for. As discussed above, parental background is likely to play a direct or at least an indirect role in track choice. We therefore get segregation by income (or SES) on top of segregation by ability.

In the tracking model by Epple and Romano [21], average socio-economic status is higher in the high track than in the low track. This is the result of the competition public schools face from private schools. Rich but less able children buy their way to better peer groups via the private market instead of opting for the lower track in a public school. In the absence of private schools, this correlation between average income and ability across the public school tracks would not prevail. In conclusion, it seems that the role of parental background in track choice and of course the correlation between income and ability drive the dynamic of segregation by income (or socio-economic status) in the Dutch-speaking education system. With respect to the tracking model by Checchi and Flabbi [15], later tracking (in so far as this goes hand in hand with less noisy test signals) would reduce socio-economic segregation.

Finally, we note that our scope has been restricted to equilibrium analysis until now. In many situations, however, segregation will arise in the absence of an equilibrium. School place shortages provide a good example. When prices are not allowed to come into play and no mechanism is put in place to transparently match students to schools, supply will fall short of demand in places. Other factors, such as status or the size of one's network, will then decide who gets what.

2.3   Race and income

There seems to be a disparity in the dynamics of segregation we have considered so far. In the Shelling model, segregation stemmed from differences in preferences: when each agent has a preference to live with agents of the same type, self-segregation occurs. On the other hand, segregation can also result from socio-economic differences (while preferences are similar), as exemplified by the Becker and Murphy and general equilibrium models. From this, it seems obvious that segregation can occur as the result of preference heterogeneity and socio-economic differences. Nevertheless, Sethi and Somanathan [47] argue that this representation is too simple. When agents choose schools or neighbour-

hoods on the basis of both race and income, the relationship with segregation becomes more complex. The two dimensions need not be race and income, but could also be language and income, or religion and income. The requirement for the relevant dimensions is that one is characterized by a preference for one's own group, and the other by a shared preference for a one group.

The authors argue that with either large or small income discrepancies between the two races, complete segregation with the minority group living in the poorer neighbourhood can be a stable equilibrium. In the first case (large income discrepancies), the minority group cannot afford to live in the richer neighbourhood. In the second case (small income disparities), the minority group does not want to pay more to end up in the richer neighbourhood (which is slightly richer but contains only members from the other group). With small income disparities, an integrated equilibrium is possible as well. In that case, members of the minority group live in both the richer and the poorer neighbourhood, according to their incomes. But this does require income differences within groups to be large enough. As a result, decreasing differences in socio-economic characteristics between racial groups may well lead to increasing segregation. The possibility of multiple equilibria leads us to consider the role of history and policy. Even when preferences change and tolerance increases, segregation may remain stable.

3 Theories of school choice and segregation in sociology

In the large sociological literature on school choice, a few assumptions often inherent in economic models are put up for discussion. As the research in Section 5 also suggests, school choice cannot be fully reduced to a simple consumer choice setting where only a one-dimensional quality measure (e.g. peer quality) and prices play a role. Certainly complete information is unrealistic. Sikkink and Emerson [49], for instance, stress the role of information within networks that are to some extent based on race. Whites seem to use ethnic composition as a first way to eliminate potential schools from their choice set. The reason is that they do not have access to higher-quality information on schools that are not predominantly white. Blacks, belonging to other networks, are able to distinguish good from bad schools that are mixed-race or predominantly black. Also as a critique on simplistic models of choice, Saporito and Lareau [44] stress that school choice should be modeled as a stepwise process, taking place within a social context. Choice is not an individual process, the authors argue, but strongly determined by race.

An even stronger focus on group-based instead of household-level processes in school choice can be found in social closure theory (Fiel [24]). Education is not simply an investment or a good to be consumed but plays a part in constructing one's identity. These identities not only serve to connect, but also to privilege some and exclude other in the access of scarce resources. Once

minority groups start to get access to these resources, the other group will start to consider other mechanisms to exclude the minority group and to safeguard its position in society. In this framework, school segregation is simply a tool to achieve such exclusion. Similarly, Sikkink and Emerson [49] conceptualize education not only as a resource (containing status and power in itself) but also as a schema (mechanisms that reproduce important aspects of social life, e.g. through role models and identification), two concepts from structuration theory. While education determines to a great extent labour market opportunities, it also functions as a schema, in the construction of educational identities. Sikkink and Emerson argue that these educational identities are more important for higher educated parents. The paradoxical result is that education may lead to stronger racial school segregation. Further evidence for the role of identities in the school choice process is provided by Ravead and van Zanten [42]. They consider school choice by middle class parents in Paris and London. They find that the objectives of education are broadly similar across different parental groups, but with different weights attached to them. Differences in values and the way the potential conflict between being a good parent and being a good citizen is resolved are key in understanding segregation.

Part II

Which preferences? Empirical research and alternative theoretical explanations

4 Empirical research into school choice determinants

Of course, school choice and segregation are closely linked. In the end, explanations of segregation must involve micro-level determinants (differences and interactions between preferences for groups and schools). From a mathematical perspective, this relationship can be understood as follows. Segregation indices are calculated from proportions in the population, which can be interpreted as probabilities (i.e. the probability that a member of a certain group chooses a particular school). In turn, these probabilities depend on the determinants of school choice. There is a one to one relationship between the probability that a student with a given set of characteristics chooses a school with another set of characteristics, and the determinants of school choice. A lot of empirical work is not necessarily concerned with macro-level segregation, but rather with individual/micro-level determinants of school choice.

One might wonder whether parents really make a deliberate choice as to which school to send their children to. Gorard [27], for instance, points out that most UK parents only consider one school, and that people do not think of themselves as consumers of education. However, that does not per se defy all rational logic behind school choice. Not making a choice is simply impossible, and if schools are very similar at first sight, time-intensive comparisons may imply higher costs than benefits. The best way to check whether people take quality, distance, denomination and other characteristics into account, is to look for patterns in the way different groups make school choices, as we do below.

We first look at studies that infer school choice determinants from surveys and questionnaires (*stated preferences*). Second, we discuss findings from studies that use a different methodology, where people's observed choices reveal their true preferences (*revealed preferences*). Lastly, we consider empirical evidence about the link between residential and school choice.

4.1 Stated preferences

Belgium Creten et al [18] look at school choice in Flanders. They find that, among the explicit school choice determinants for primary schools, atmosphere and school image are the most important elements. Distance seems to matter less. School denomination follows distance to school on the 10th and 11th place out of 44 determinants. Compared to overall quality and distance, denomination

thus seems less important. This is roughly similar for secondary school choice, where quality takes on a more result-oriented meaning (e.g. maximizing the child's chances on the labour market or with respect to continuing education). The number of students from foreign origin seems to matter less, but this group also happened to be relatively small in the schools where the survey was held. De Rycke and Swyngedouw [19] find that this does not hold for Brussels, where Belgians seem to use the proportion of migrants as a proxy for school quality. Turks and Moroccans (representing the two main countries where Belgian migrants come from) are found to be strongly opposed to concentration schools as they understand such schools will not contribute to social inclusion and are detrimental for their chances to climb the social ladder.

Nouwen and Vandenbroucke [40] find that weaker groups in society (low SES parents and parents from ethnic-cultural minorities) tend to visit fewer schools before making a choice. They also find that parents from these groups are less selective in the overall school-choice process in that they are less likely to disregard a school for quality reasons (i.e. on the basis of teacher quality, reputation, discipline, etc). Reported tolerance levels with respect to the percentage children from ethnic minorities are also higher for these groups, implying again that these parents are less likely to reject schools on the basis of student composition.

The Netherlands In a 2002 report on the Netherlands, Karsten et al [32] find that native Dutch parents in the first place look for accordance between their home and school environment. This measure can be decomposed into atmosphere, perspective on education, and cultural and religious background. It is clearly related to the type of students the school attracts. Distance and general school level are more important for lowly educated parents compared to highly educated parents. Immigrants are more likely to focus on quality and differentiation, in particular whether remedial practices exist to support children with an educational or language backlog. In accordance with Sikkink and Emerson [49], Karsten et al [32] find that highly-qualified native Dutch parents use student composition as a main criterion not to consider a school. Still with respect to the Netherlands, Denessen et al [20] argue that school choice does not lead to socio-economic segregation in a direct way. Using survey data, they find similar school choice determinants as Karsten et al [32], and subsequently investigate whether the importance of these determinants changes with parental characteristics. Heterogeneity among parental preferences runs along religious lines, with Muslim schools as the clearest example. Social background seems not to change the order or relevance of various school determinants.

US and UK Focusing on the reasons why parents reject schools, Bagley et al [2] find similar results for the UK. The foremost reason not to consider a school is distance, followed by the school's students (in terms of "appearance and manners") and its ethnic composition (although this reason was only cited by those parents living in a multi-ethnic region). For the US, Schneider and Buckley [46] look at different studies using survey data and report that academic

quality is the main type of information parents are interested in (with teacher quality as the response topping several lists).

4.2 Revealed preferences

Thus far, only stated preferences were considered, often to be selected from a predefined list. Using discrete choice models, preferences are inferred from observed choices. The relative importance of the determinants can then be derived (i.e. real choices involve trade offs[10]) and differences between types of families can be identified. Perhaps most importantly, the risk that people give socially acceptable answers is eliminated.

United States Glazerman [26] was among the first to point at the risks of only relying on survey methodology. Especially with closed questions, wording is very important. When one study concludes that "similarity between school and home environment" is very important, others find that parents care little about the social class of fellow students. While these two criteria may seem to overlap to an important extent, the first one has a more positive connotation than the second one, which is more easily interpreted as intolerance towards living with other groups. In the study by Glazerman [26] educational quality comes out as a much less important determinant of school choice than can be expected on the basis of questionnaires. He concludes that variables as SES and ethnicity play a more important role than people dare to admit.

Another possibility is to consider search behaviour. Schneider and Buckley [46] analyse data from a website where parents can compare schools from Washington DC. They find that school composition is the school attribute most searched for. Furthermore, over time the profile of schools people visit (electronically) does not change in terms of quality (reading and math scores), but they do change in terms of composition: over the search paths, parents do become less likely to "visit" black schools. This behaviour (ranking of school characteristics) does not correspond well to what parents report in surveys. Of course, it may still be that parents use the percentage of blacks attending a school as a quality indicator. This is not entirely convincing, however, as survey respondents indicate that the most relevant dimensions of quality are teacher quality and test scores (which could be observed directly).

Hastings et al [29] use a mixed logit model to derive school determinants and find slight heterogeneity in preferences for distance (with whites being more sensitive to distance than non-whites). They also find evidence for a preference for one's own race at school, with 70% of students belonging to the same group as the preferred school composition. Preferences for quality (higher test scores) are shown to be stronger for high SES than for low SES students (those receiving lunch subsidies).

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[10]Of course, the problem with using lists to infer the ranking of different determinants is that it is not possible to infer trade offs. Take for instance the paper by Creten et al [18]. Distance occurs as less important than school atmosphere. For very long distances, however, distance to school will eventually become the most important variable.

Bayer et al [5] show that socio-demographic characteristics (income, language, immigrant status, etc.) have the potential to largely explain racial segregation between some groups, but much less so between others (especially blacks and whites). In other words, when we control for a host of other variables, ethnicity will not matter much for school choice, except for segregation between blacks and whites. This constitutes a warning that one must be careful to extrapolate findings from one region to another. Racial tensions between blacks and whites in the US have a long history, which cannot be compared with the arrival of other ethnic groups in the US or in Europe.

Saporito [43] looks at applications to magnet schools in the US. Magnet school choice can be considered as an opt out of the local public school. He finds that whites are more likely to apply to magnet schools as the percentage of non-whites in the neighbourhood increases. While children from well-off parents are also more likely to apply to magnet schools than their poorer peers, this effect disappears once school quality is controlled for. Again, part of what may seem to be a preference for race can be traced back to socio-economic differences.

Jacob and Lefgren [31] provide evidence that goes against some of the conclusions reached above (of important differences between parental preferences). Looking at preferences for types of teachers, they find that, parental preferences for student satisfaction relative to academic achievement are similar across socio-economic backgrounds *within* schools. *Between* poor and rich schools, however, important differences exist. And in general, low-income parents are less likely to actively request teachers; they are less assertive. The authors point out that their overall findings are consistent with a model in which people have similar preferences for school quality but, depending on other circumstances such as school composition, prefer other types of teachers to reach similar objectives. This makes it less likely that differences in parental preferences for school quality cause segregation. Of course, different preferences for group composition might still play a role in the sorting of students between schools, as well as differences in sensitivity to distance. This conforms with the findings by Hastings et al [28] that minority parents (when the minority is poorer on average, as is often the case) face a trade off between school quality and the presence of peers from their own (minority) group. In another study, Hastings et al [30] find that low SES parents do not necessarily place less weight on academic achievement. They show that the apparent difference in sensitivity to quality between high and low SES parents can be partly remedied by providing them with easily accessible information on test scores. This suggests that part of the preference differential is in fact due to differences in access to information.

The Netherlands Borghans et al [9] use survey and administrative data for the South Limburg region. They use average test scores and the outcome of the inspections assessment as indicators for school quality. This measure is found to influence school choice, but not as much as school denomination or educational philosophy. They also find heterogeneity for school characteristics among the population (sensitivity for school quality, denomination, and teaching philoso-

phy), where higher educated parents seem to be more sensitive to school quality or more likely to pick a school following an alternative teaching philosophy. Not surprisingly, heterogeneity with respect to denomination is particularly strong.

Koning and Van der Wiel [33] find that publicly available information on school quality has an impact on student intake. This effect is strongest with regards to the academic track, but this cannot be explained by differential quality preferences between socio-economic groups, who seem to value quality equally.

United Kingdom Burgess et al [12] find that ethnic composition does not matter much on average (which, of course, may simply imply that the preferences for whites and non-whites cancel each other out on average[11]). In their model, socio-economic variables and distance to school are the key determinants of school choice. However, the role of these socio-economic determinants and differences between groups become smaller when the choice sets are defined in a more realistic way (i.e. not using the crude criterion based on distance alone, but using the schools' actual catchment areas[12] in the previous school year). The authors conclude that the main difference between societal groups is not in preferences, but in feasible choice sets. This is in line with other research by Burgess, which indicates that place of residence (and thus distance to school) is the main reason why poorer students are less likely to attend good schools [11]. When choice sets are defined in terms of distance, disadvantaged students have more schools to choose from and the likelihood of obtaining one's first school choice is similar across socio-economic classes [13]. Nevertheless, when defining choice sets on the basis of *actual* catchment areas, a large proportion of schools within 3 km distance is no longer included in the choice sets of disadvantaged students compared to those of more advantaged students. It also appears that the similar success ratios for both groups to obtain their first school choice is caused by the fact that low SES parents make less ambitious school choices (i.e. they are more likely to select schools with lower test scores).

4.3   Neighbourhood choice and school choice

To what extent do people make simultaneous school and neighbourhood choices? The interrelatedness of the two choices are underlying all of the general equilibrium models discussed in Section 2.2. This does not imply that the correlation between school characteristics and neighbourhood composition or house prices

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[11]It is not clear from the paper whether the authors added interaction effects to their multinomial logit models. An insignificant effect of ethnicity is possible even when preferences to live with members of one's own race are quite strong. However, it is also possible that pure ethnic preferences really are very small in the UK. This latter idea would connect well with the paper by Bayer et al [5], in which the authors argue that ethnic preferences are in fact preferences for socio-economic characteristics.

[12]We use *school catchment area* for the area in which students are eligible to go to a certain school. To indicate the area in which a school's students actually live, we use the term *actual school catchment area*. The actual school catchment area is thus by definition a subset of the school's (official) catchment. With free school choice as in Flanders, every school belongs to the parents' choice set. In that case, each school's (official) catchment covers the whole region.

amounts to a direct causal relationship. Much of the relationship is indirect (via the social multiplier), as is discussed below.

Nechyba and Strauss [39], for instance, show in a discrete choice setting that for residential choices in 6 US districts, per pupil public school spending[13] is a significant determinant of community choice. They control for a host of other variables like crime rates and commercial activity, but not for social or ethnic composition.

Typically, economists try to derive the impact of school quality on neighbourhood choice from the effect of school quality on house prices. For a good overview of such studies, we refer to Black and Machin [8], who conclude that willingness to pay for school quality is reflected in higher house prices. Barrow [3], for instance, finds evidence for capitalization of school quality in house prices, but only for white families. Bayer et al [4] make use of a regression discontinuity design. The strength of the relationship they find, however, is weaker than in previous studies. This logic also plays a role with racial segregation, where price differences between black and white neighbourhoods are entirely due to unobserved differences between neighbourhoods. The authors categorize segregation between races and education levels as "self-segregation": it does not require the emergence of price differentials. In a last study, Clapp et al [16] come to similar results, concluding that the capitalization effect is small compared to the socio-demographic effect (percentage Hispanic) on prices.

Social multiplier   Often aggregate relationships seem to overstate the individual elasticities or preferences, pointing to the presence of social multipliers (Glaeser and Sacerdote [25]). The Becker model (figure 7) provides a good example: although preferences for the amenities between the two groups are only slightly different, a significant price difference followed. In that case it is another preference, namely for one's neighbour, which makes for the strong aggregate relationship between neighbourhood amenities and willingness to pay. With the capitalization of school quality in house prices, the analysis is similar. Although people react only to a limited extent to changes in school quality (as measured by test scores or teacher quality), ensuing changes in the school's socio-economic composition may give rise to much stronger overall increases in willingness to pay for housing nearby.

Relevance for education policy in Flanders   A significant relationship between neighbourhood and school choice seems reasonable in countries with no (or limited) school choice. In these countries, neighbourhood choice places an effective constraint on one's school options. But even when school choice is completely free, as is the case in most of Flanders[14], distance to school is one of

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[13]In their sample at least, per pupil public school spending is a good predictor for educational quality (i.e. test scores).

[14]As mentioned before, some cities or school groups use so called "allocation registers", which take into account distance to school in assigning school places. One can see this as a limit on free school choice. On the other hand, such measures only *bite* when demand for places at certain schools exceeds supply. As long as the number of registered students is larger

its main determinants. Not allowing for any role of school quality in the process of neighbourhood choice seems naïve. This would amount to assuming that, for instance, information about serious place shortages in local schools (as is the case in Brussels and other cities nowadays) would have no impact at all on the residential decisions of young families.

Furthermore, school and neighbourhood choice may be difficult to disentangle. Given that school choice seems to depend more on ethnic and social school composition than on other school quality measures such as test scores, it may be difficult to distinguish school preferences from neighbourhood preferences. In light of this, a tightening of the link (e.g. through using distance to school as a ranking criterion for school allocation) between residential location and school entry may not have a large impact on neighbourhood segregation.

The possible impact of the allocation mechanism on residential segregation is further weakened through the inclusion of other criteria, apart from distance to school. Socio-economic position is the most relevant one here. In order for school composition to reflect neighbourhood composition, low SES students are given priority over a certain proportion of a school's available places, while high SES students receive the same priority over the other places. This proportion is based on the relative presence of the two groups in the wider area or LOP. Assuming that the composition of the population within the LOPs is held constant, one would get increased residential segregation. The houses closest to schools would be sold to members of the high SES group (as their incomes are highest and as housing and schooling are normal goods). The extreme case is depicted in figure 12. The most preferred school is at the centre and the high (H) and low (L) SES group are indicated in grey and white respectively. Since places are reserved for both socio-economic groups, complete socio-economic segregation does not occur at the school level[15]. Residential segregation, however, is very high. This would be mitigated if we take into account uncertainty about the maximum distance one can live from school and still be guaranteed a place. This distance may be unclear and will change yearly as the number of available places and the demand for them fluctuates.

than the number of available places, nothing changes relative to the default situation without allocation register.

[15]Remark that this only holds when the reference population stays constant. If movements between LOPs occur, the picture changes and complete socio-economic segregation becomes a theoretical possibility. But for this to occur, very large movements have to occur at the LOP level, which are unlikely to be the result of differences in school quality.

Figure 12: Extreme case of residential segregation with a distance-based allocation mechanism and no inter-regional mobility
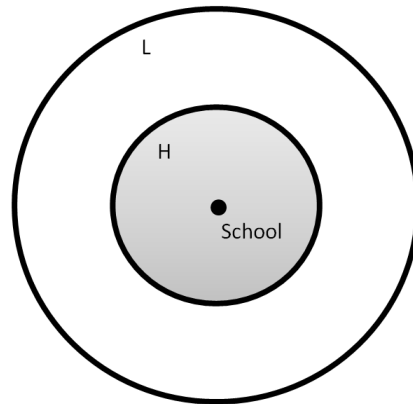
5   Incomplete information and restrictions on choice

In this section, we broaden our view and consider not only how segregation might be the result of an interaction between preferences and individual characteristics (e.g. income or ability), but also how information, choice restrictions and school policies influence the outcome of the choice process. In the last section, we already came across the work by Burgess et al ([11], [12], and [13]) who showed that choice may be more restricted for low SES groups than for high SES groups. We also discussed a study by Jacob and Lefgren [31], indicating that low-income parents are less likely to actively request teachers; they are less assertive. Although preferences between groups are similar, various groups may obtain different outcomes depending on the size of their network or whether they understand how to play the system. Other evidence for the idea that the choice process, rather than preferences themselves, might differ across social groups is provided by Kristen [34] in a study of primary school choice in Germany. She asserts that Turkish parents have a different perception of school alternatives than native German parents. In short, they are more likely to consider only one school since they are more unfamiliar with the school system. Essentially, this is a critique on many of the above models, which represent school choice as a cost-benefit exercise involving a set of schools but do not elaborate on the way individuals perceive or construct this choice set. Furthermore, schools may throw up barriers preventing the execution of free choice. The first issue seems most salient in her study, as different ethnic groups have different choice sets. This ethnic variation, however, completely reduces to differences in information. The more educated migrants are, the less their choice sets will diverge from those of native Germans. This is reminiscent of the study by Hastings and Weinstein [30], showing that the information gap could be overcome by providing disadvantaged parents with easily accessible information.

The role of schools   While providing disadvantaged parents with better information would move us in the direction of a level playing field, schools may not have an incentive to do so. On the contrary, if schools are aware that parents take the school's socio-economic profile into account when making choices, they may prefer some information to spread via networks that high SES parents have easier access to.

   While Kristen [34] did not find evidence for school discriminatory practices, survey evidence suggests that schools do play an active role in the continuation of segregation (e.g. Nouwen and Vandenbroucke [40] for Flanders). They can do so by profiling themselves to a certain public, by using a specific communication strategy, or by advising students from minority groups to choose another school. In a study student intake in religious schools' in London, Allen and West [1] discuss the ways in which these schools contribute to socio-economic segregation, which is not only the result of self-selection (typically on the basis of religion) by students, but also of selection procedures (e.g. interviews and school-administered tests). For the Netherlands, Borghans et al [9] show how different teaching philosophies cater to different groups of parents. Alternative

teaching practices, for instance, are especially popular with highly educated parents and can thus be an effective means for a school to realize a more advantaged student composition without being overtly discriminatory.

Information and search costs In the paper by Sikkink and Emerson [49], information circulates in ethnicity-based networks. As such, white parents find it difficult to evaluate the quality of predominantly black or even mixed-race schools. Similarly, Lundberg and Startz [35] show how self-segregation occurs in three different set-ups when agents possess limited information on the quality of transactions with members from other groups. This dynamic of self-segregation is likely to be self-supporting, since segregation will only lead to less information about members from other groups and thus to even more segregation. The model also predicts that segregation will be more prevalent when the minority group is smaller. In that case, the investment to acquire information about the minority group becomes less worthwhile since opportunities to engage in a transaction with a minority group member are low.

6   Discussion

This paper has looked at different theoretical explanations for school and neighbourhood segregation. We started with a preference-based approach. In the Schelling model [45], rather weak preferences to live with one's own group are sufficient to sustain high levels of segregation and to explain a tipping dynamic. A lot of evidence for different preferences for school composition across ethnicities exists, especially between whites and blacks in the US. In general, however, these heterogeneous preferences are to a great extent reducible to preferences for socio-economic characteristics. The latter type of preferences tend to be more homogeneous across groups, for instance when everyone, independent of his own background, prefers schools with a high socio-economic profile to more disadvantaged schools. These preferences tend to be more pronounced when parental SES is strongly correlated with ability. In general, the more research has delved into preferences for school characteristics, the more these preferences resembled each other across groups. Providing easily accessible information to low SES families or taking into account differences in residential location and effective choice sets all result in smaller differences in school choice determinants between SES groups. One of the main insights provided by the reviewed models is that small differences in preferences for group composition are sufficient to sustain segregation. This conclusion holds even when most people prefer integration over extreme segregation on a societal level.

With homogeneous preferences, segregation is still a likely outcome, sustained through implicit or explicit mechanisms to ration access to schools. These mechanisms can come in many forms, and can be related to tuition levels, distance to school, ability or a combination of them. Even when distance to school is not an explicit criterion, transport costs will always play a role and induce a spillover of neighbourhood segregation to school segregation. When this link between neighbourhood and school composition is established, we arrive in an equilibrium characterized by price differences, reflecting differences in willingness to pay between neighbourhoods. With heterogeneous preferences, prices are not needed to sustain the equilibrium. In order not to increase the level of neighbourhood segregation in an attempt to desegregate schools, policymakers should be careful when using the distance criterion, for instance by applying it to allocate places *within* SES groups only, as is done in the LOPs of Brussels, Ghent and Antwerp.

We conclude with two remarks on the limits of the (mainly economic) literature we reviewed above. First, although many models stress the existence of multiple equilibria and therefore the history of segregation in determining the current distribution of students over schools, we can go one step further. Preferences for school composition should not always be treated as given. School choice processes take place within a social context and are thus subject to change over time. In this sense, history plays a more fundamental role and helps to understand why segregation between some groups (e.g. between natives and recent migrants) is related to socio-economic differences while segregation between other groups is more structural (e.g. between blacks and whites in the

US). Second, we have mainly taken the perspective of the demand for education. However, one should be aware that not all changes in segregation can be categorized as self-segregation or attributed to incomplete information or differences in choice sets, but that schools may also steer the choice process and impact on segregation in subtle ways. From the perspective of the supply of education, the academic literature is limited to rather anecdotal evidence.

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