The Effects of School Choice on Segregation of Finnish Comprehensive Schools

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Economics
Master's Thesis
May 2014

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Tiedekunta/Osasto – Fakultet/Sektion – Faculty Faculty of Social Sciences		Laitos – Institution – Department Economics
Tekijä – Författare – Author Isa Elena Kuosmanen		
Työn nimi – Arbetets titel – Title The Effects of School Choice on Segregation of Finnish Comprehensive Schools		
Oppiaine – Läroämne – Subject Economics		
Työn laji – Arbetets art – Level Master's Thesis	Aika – Datum – Month and year May 2014	Sivumäärä – Sidoantal – Number of pages 58 + 20

Tiivistelmä – Referat – Abstract

School choice was introduced to the current comprehensive schooling system in Finland during the mid-1990s as a result of several small policy changes. Student sorting is still mainly based on proximity, but students are allowed to apply to another school. The ease of applying and being accepted into other than your assigned school varies between municipalities. Even though the proportion of students exercising choice is considerable, the effects of the Finnish reform are relatively understudied and the research is mostly conducted by educational scientists, leaving out the logic of economics through which school choice was originally justified.

The purpose of this thesis is to study the effects of school choice on segregation of schools using joint application data of ninth graders ending comprehensive school and applying to secondary education in 1996 to 2004. Segregation of schools is measured over time at municipal level using municipalities with at least two schools. The very well-known Duncan index and variation between schools are used to measure segregation of schools. Also, isolation index is used to measure segregation of schools by foreign speaking students. Indices are adjusted to measure segregation from randomness. The development of these measures is studied more closely for the Capital City region. In addition, fixed effects model is used to explain the segregation indices by the share of students attending local school and residential segregation.

Segregation increases steadily from 1996 to 2004 in Helsinki by high school attendance, high school graduation and GPA. Segregation is lower and stays almost constant for Vantaa, where school choice has been more limited from the beginning. All measures for segregation of schools by foreign students for Helsinki and Vantaa are somewhat inconclusive. Using municipality fixed effects model to explain segregation indices by schools' share of local students and residential segregation indicates that in cities with high share of students attending their neighborhood school segregation of schools by high school attendance and graduation decreases. However, results are insignificant for the rest of the measures and it seems that residential segregation explains the segregation of schools for all measures. Fixed effect model may suffer from endogeneity.

The results indicate increasing segregation of schools by ability in Helsinki after the reform and the fixed effect model to some extent supports these findings. Measures are still quite moderate. More data on before the reform is required to make any causal interpretations on the effects of the school choice reform. The evidence suggests that the underlying residential segregation plays a key role in segregation of schools. School choice is believed to alleviate the pressure of 'selection by mortgage'. Therefore, the effects of the reform on residential segregation should be studied before we consider limiting school choice in Finland.

Avainsanat – Nyckelord – Keywords
Segregation School Choice Reform Duncan Index Isolation Index Variation between Schools Fixed Effects Model

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Valtiotieteellinen tiedekunta	Taloustiede

Tekijä – Författare – Author
Isa Elena Kuosmanen

Työn nimi – Arbetets titel – Title
Kouluvalintojen vaikutus koulujen väliseen segregaatioon Suomessa

Oppiaine – Läroämne – Subject
Taloustiede

Työn laji – Arbetets art – Level	Aika – Datum – Month and year	Sivumäärä – Sidoantal – Number of pages
Pro Gradu -tutkielma	Toukokuu 2014	58 + 20

Tiivistelmä – Referat – Abstract

Kouluvalinnat rantautuivat Suomeen 90-luvulla vaiheittaisten lakiuudistusten seurauksena osana valtionhallinnon hajauttamista. Pääasiallisesti oppilaat jakautuvat edelleen kunnan osoittamiin lähikouluihin, mutta oppilas voi halutessaan pyrkiä toisen oppilaaksiottoalueen kouluun tai painotettuun opetukseen. Kouluvalintojen toteutus on kuntakohtaista ja toiseen kouluun hakemisen helppous vaihtelee. Vaikka kouluvalinnat ovat erityisen suosittuja isoissa kaupungeissa, kouluvalintareformin vaikutuksia on tutkittu hyvin vähän ja pääasiallisesti kasvatustieteilijöiden toimesta. Tämän tutkielman tarkoitus on tuoda taloustiede takaisin kouluvalintakeskusteluun Suomessa, sillä nykytutkimuksesta ja -keskusteluista jätetään pois taloustieteen logiikka, jolla kouluvalinnat on alun perin perusteltu.

Tutkielma tarkastelee kouluvalintojen vaikutusta koulujen väliseen segregaatioon käyttäen yhteisvalintarekisteriaineistoa vuosien 1996 ja 2004 aikana peruskoulunsa päättävistä yhdeksäsluokkalaisista. Koulujen välinen segregaatio lasketaan vuosittain kuntatasolla. Segregaatiota mitataan keskiarvon, lukioon ja ylioppilaaksi pääsyn, sekä vieraan äidinkielen perusteella ja mittaamiseen käytetään Duncan indeksiä, koulujen välistä varianssia, sekä eristyneisyysindeksiä. Kaikki indeksit muokataan mittaamaan segregaatiota satunnaisuudesta. Segregaation kehitystä seurataan tarkemmin pääkaupunkiseudulla. Lisäksi kouluvalintojen vaikutusta segregaatioon tarkastellaan kiinteiden vaikutusten mallin avulla, jossa koulujen välistä segregaatiota selitetään kouluvalinnoilla ja alueellisella segregatiolla.

Koulujen välinen segregaatio kasvaa Helsingissä vuosien 1996 ja 2004 välillä lukioon ja ylioppilaaksi pääsyn, sekä keskiarvon perusteella. Vantaalla, jossa kouluvalinnat ovat hyvin rajoitettuja, koulujen välinen segregaatio on alhaisempaa, eikä osoita kasvun merkkejä. Segregaatioindeksit vieraskielisten oppilaiden perusteella ovat samankaltaisia ja -suuruisia sekä Helsingissä että Vantaalla, eikä merkittävää kasvua ole havaittavissa. Regressiotulokset kiinteiden vaikutusten mallista osoittavat, että kunnan lähikoulua käyvien oppilaiden osuus vähentää koulujen välistä segregaatiota lukioon ja ylioppilaaksi pääsyn perusteella. Vaikutus on kuitenkin vähäinen ja muiden mallien estimaatit eivät ole merkitseviä. Sen sijaan alueellinen segregaatio selittää kaikissa malleissa merkitsevästi koulujen välistä segregaatiota. Regressiomalli saattaa kärsiä endogeenisyydestä ja aiheuttaa estimaatteihin vinoumaa.

Koulujen välinen segregaatio oppilaiden osaamisen mukaan kasvaa Helsingissä kouluvalintareformin jälkeen, mutta päätelmiä kouluvalintojen ja lisääntyneen segregaation kausaalisuhteesta on vaikea tehdä. Koulujen välisen segregaation trendi ennen reformia tulisi selvittää lisäaineistoilla. Tulokset kuitenkin viittaavat siihen, että alueellinen segregaatio ohjaa koulujen välistä segregaatiota Suomessa. Viimeaikoina on esitetty kouluvalintojen rajoittamista koulujen välisten erojen pienentämiseksi. Ennen kuin valintoja rajoitetaan, niiden vaikutus alueelliseen segregaation tulisi selvittää, sillä kouluvalintojen rajoittaminen ei välttämättä vähennä koulujen välistä segregaatiota mahdollisten alueellisten segregaatiopaineiden takia.

Avainsanat – Nyckelord – Keywords
Segregaatio Kouluvalinnat Duncan indeksi Eristäytyneisyys indeksi Koulujen välinen varianssi Kiinteiden vaikutusten malli

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1. Introduction

School choice policies are frequently used to describe policies that enable parents and children to either freely choose their school, or at least state their preferences, or choose between private and public schools. The advocates of these policies see school choice as a way of improving school quality and productivity by the introduction of competition between schools. From the theory of the firm, increasing the range of options (more schools to choose from) forces schools to compete for students which should ultimately lead to improved school quality. (Bayer & McMillan, 2005)

Furthermore, school choice policies are seen as a solution to 'selection by mortgage' problem, where the house prices have a premium in high attaining school districts, thereby pricing out students from poorer families. On the other hand, some concerns have been raised, especially by behavioral and educational scientists, and school choice is seen as a cause for socio-economic and racial segregation of schools, where schools 'skim the cream' and select students from better backgrounds. School choice seems to be the privilege of wealthier and better educated families who are more informed about available choices and put more weight on the education of their children. (Harris, 2010) However, earlier research and economic theory is somewhat inconclusive on the possible effects of school choice policies.

School choice was introduced to the current comprehensive schooling system in Finland during the mid-1990s as a result of several small policy changes. Unlike in its international counterparts, the introduction was made mainly in consensus and only a handful of questions were raised at the time (Seppänen, 2006). Student sorting is still mainly based on rigid catchment areas according to which students are assigned to their neighborhood schools. However, students are allowed to state their preference and apply to another school. The ease of applying and being accepted into other than your assigned school varies between municipalities. For example almost half of the students in seventh grade apply and around 80% of them get accepted to other than their assigned school in Helsinki (Seppänen, 2006). Even though the proportion of students exercising choice is considerable, the effects of the Finnish reform are relatively understudied and the research is mostly conducted by educational and behavioral scientists (see for example Seppänen (2006)).

Empirical studies and theoretical papers on school choice are numerous and can be divided into three main branches of research: student outcomes, segregation of schools, and school productivity. This thesis focuses on the possible consequences of the reform on segregation of Finnish schools. The topic has gained publicity recently in Finland and raised a lot of concerns on the increasing separation of schools into rejected and popular ones, especially in bigger cities (Turun Sanomat, 30.5.2013). Perhaps due to the lack of proper data and poor access to the existing ones, earlier Finnish studies have mostly been cross-sectional or survey studies based on questionnaire data. Consequently, this thesis studies whether segregation by foreign language, GPA, and high school attendance and graduation has increased after the reform.

I use joint application data of ninth graders ending their comprehensive school and applying to secondary education (i.e. to high school or vocational studies). The data runs from 1996 to 2004. I intend to measure segregation of schools over time at municipal level using municipalities with at least two schools. I use the very well-known Duncan index and more inherent measure to economists, R^2, to measure segregation of schools. Also, I use isolation index to measure segregation of foreign speaking students. The development of these measures is studied more closely for the capital city region. Previous studies, for example on the PISA results, have shown that variation in student outcomes, that can be explained by the schools attended, R^2, is the highest in Helsinki (Kuusela, 2006). Bernelius (2013) has shown that residential segregation alone does not explain the segregation of schools in Helsinki. Thus focusing on Helsinki and comparing it to its neighboring municipality, Vantaa, which has taken a much more stringent stand in the ease of choosing a school (Turun Sanomat, 30.5.2013) could shed some light on the effects of the reform. In addition, the possible effects of school choice on segregation of schools are studied using a municipal fixed effects model. Segregation indices are explained by the share of students attending local school and residential segregation. The gradual introduction of the school choice is more than likely to have caused some movement even before my data begins and hence there is no clear before and after reform setting.

The results show an increasing trend in segregation of schools by ability in most of the biggest cities after the reform. There is a clear difference between the development of segregation of schools by ability between Helsinki and Vantaa but segregation of schools by foreign speaking students shows no trend. According to the fixed effects model, estimates for choice are small and significant only for segregation by high school attendance and graduation. Whether school choice has actually increased segregation of schools is inconclusive, and more data on before the reform is required to make causal interpretations on the effects of the reform on segregation of schools. Before there are any hasty policy changes on limiting school choice, as recently suggested by the director general of the Finnish National Board of Education (Liiten, 2012) the effects of schools choice on segregation of schools should be investigated more thoroughly. Similarly, a study on the effects of the reform on residential segregation is essential in determining the faith of school choice in Finland. It could also help to understand and predict the effects of limiting choice.

2. Theory and Mechanisms of School Choice

The idea of school choice was originally introduced by economists and its most famous advocate is none other than Milton Friedman who in 1955 published the article *The Role of Government in Education.* The article suggests less government involvement in provision of education and more competition between schools, which would lead to productivity and variety increases. However, the debates and research nowadays, especially in Finland, are mostly conducted by educational scientists leaving out the logic of economics through which school choice was originally justified. (Hoxby, 2006) First, I will go through the general logic of school choice and the next section describes the link between residential segregation and school choice. The third section continues with theories on possible causes behind increased segregation of schools.

2.1. School Choice and General Equilibrium Improvements

Government intervention in provision of education is justified by positive externalities, and in the absence of intervention people make insufficient investments in it. Nevertheless, as Hoxby (2006) highlights, an important point that is usually forgotten in the discussions relating to provision of education is that one does not consume education, one invests in it. Therefore government intervention is not justified by its redistributive role, but rather its role for intervention in the imperfect capital markets for financing education of children. Imperfect capital markets spring from the fact that families might be uncertain about the level of investment in human capital they ought to make. Also, given a financially constrained but gifted child, it is difficult to convince the financier of his/her abilities and human capital cannot be used as collateral. Third reason for imperfect capital markets of financing education is that individuals are unable to diversify their investments properly, exposing them to risks that cannot be insured against without severe moral hazard problems. (Hoxby, 2006)

School choice is often mistakenly linked to *laissez-faire*[1] policies but it is better described as a form of government intervention. The idea is that government intervention is limited to solving the financing of education. As a financier, it is in government's best interest to supervise its investments by setting prices for education and providing, for example, guidelines for curriculum. This way it can be guaranteed that schools compete on an equal basis. Therefore, solving the market imperfections and overseeing the process is thought to be more optimal than direct government provision of education or quantity regulation of school. (Hoxby, 2006)

Hoxby (2006) proposes two channels through which school choice policies could create general equilibrium improvements: competition between schools and better match quality of students and schools. However, there are couple of essential features school choice policies should have in order to generate improvements. Otherwise, school choice policies are likely to just sort students according to their ability or other attributes. First essential element is the flexibility of the supply of education, where schools can open and expand as they see fit: if the amount of seats and schools is a fixed good, and oversubscribed schools do not get rewarded, bad schools will still fill their seats. In this type of setting, schools can still compete for the match quality: i.e. skilled students are easy to teach and score same results with less money. However, there might not be improvements in the productivity of schools: Consider public schools with fixed funding (i.e. per pupil), that can attract skilled students who learn faster. These schools have on average more money to spend on something else than the basic curricular activities. Thus student outcomes in these schools might improve. On the other hand, teachers in poorly performing schools will teach on average less skilled students who require more attention and money. (Burgess, McConnel, Propper, & Wilson, 2007) These schools will see deterioration in their student outcomes. Overall, improvements in

[1] *Laissez-faire* is a term reflecting minimal government involvement in regulating markets. For example, in education this would mean that government has no interest at all in the provision of education and it would be best left to the market forces (Hoxby, School choice : three essential elements and several policy options, 2006).

average student outcomes are likely to be close to zero. This type of competition leads to segregation of schools and is discussed more in section 2.2.

The second essential element suggested by Hoxby (2006) is that funding should be based on the number of students or applicants. In other words, funding should be based on per pupil costs and all students, whether from school's own catchment area or outside it, should be fully covered. This way those schools that lose some of their students to higher attaining schools will lose some of their funding as well. Otherwise schools do not have an incentive to fill their seats, expand in the case of over demand, or take students from outside their own catchment areas. To think of it, per pupil funding is actually the precondition for having flexible supply.

The third essential element is the independent management of schools. If schools are independent they can innovate and use funds for technology, hiring, school trips and so forth, as they see fit. Usually, however, even though there would not be any strict curriculum or pedagogical method, schools are unable to make independent hiring decisions and teachers' wages are subject to collective bargaining especially in many European countries. In this type of setting, schools are unable to compete properly as they cannot attract and reward more able teachers by bonuses or better salaries. (Hoxby, 2006) Then again, schools that perform better and attract skilled students can in some cases attract the best teachers as well: it is probably more rewarding to teach a class that is motivated and eager to learn (Burgess, McConnel, Propper, & Wilson, 2007). Again, we end up in a situation where school productivity might not increase but the quality of 'inputs' is better matched between schools leaving some schools to do with less skilled teachers and students. (Bayer & McMillan, 2012)

2.2. Tiebout Sorting and School Choice

Tiebout sorting is a model that describes local public goods and services provision and neighborhood segregation in an urban setting. Tiebout originally published his paper of the model to respond to criticism of decentralized public provision. (Tiebout, 1956) The basic idea of the model is that there are urban neighborhoods each providing different amounts of public good at certain level of taxes. Families are expected to be fully mobile and able to choose the neighborhood that maximizes their utility. They are also assumed to be perfectly informed. The model predicts that families with similar preferences and income will end up living in the same neighborhood. Preferences for the level or quality of public service, such as schooling, are linked to family characteristics. In the simple case of having homogenous families with heterogeneous incomes, the model predicts districts ordered by income. The essential part is that given for example a change in public good provision families are able to 'vote with their feet' thus revealing their preferences. (Bayer & McMillan 2012)

Tiebout sorting is an urban phenomenon. In a real urban setting, however, family characteristics and preferences tend to be complex. (Bayer & McMillan, 2012) In addition, neighborhoods or communities in the same municipality rarely provide differing levels of public goods or have a different level of taxes. In this type of context, possible sorting of neighborhoods is driven by peer-group effects as the perceived quality of public goods, such as schools, can still differ between the neighborhoods. Hence in the vicinity of highly attaining school, families might have to pay a premium over house prices. Consequently, families with higher income and higher preference for their children's education will locate near the highly attaining school. These families will reinforce the perceived quality differences between neighborhoods and their schools. (Brunner, Cho, & Reback, 2012) Of course, this type of neighborhood segregation is not as extreme as predicted in the simple case of Tiebout sorting. Nonetheless, some form of sorting will take place within and across neighborhoods in a more complex urban setting.

In a real urban setting, families are likely to face constraints from housing markets to employment opportunities leading to imperfect mobility. Families might have to sacrifice living in their preferred neighborhood in order to pursue a career of their liking. Especially, if commuting takes time and is expensive, families could locate themselves near their workplace regardless of the characteristics of the neighborhood. This could possibly limit the extent of neighborhood segregation predicted by Tiebout sorting. (Bayer & McMillan, 2012) Families are also assumed to be making decisions under perfect information, while in reality decisions are based on educated guesses of school quality and neighborhood structure. For instance, in many countries authorities do not publish student outcomes or ranking lists of schools and school choices may be based only on observed characteristics, such as proportion of immigrant students. (Kane, Staiger, & Riegg, 2005)

As discussed, families will in part base their residential decisions on local public goods and services provision, such as schooling. Moving to a certain neighborhood that belongs to the catchment area of a high attaining school is quite common in the absence of school choice possibilities. Neighborhoods will stratify according to their preference of schooling and, of course, according to income as house prices near high attaining schools increase. School choice policies have been proposed as a relief for socio-economic segregations of neighborhoods. For instance, Brunner et al. (2012) describe a model of two adjacent districts with differing household incomes, house prices and qualities of public goods and services provided. District 1 has originally lower average income and house prices and its school is not as well performing as in district 2. When school choice is permitted, families from the lower end of the income distribution of district 2 are likely to be indifferent between living in the cheaper district 1 or district 2 for they can still get their children to the better school of district 2. Hence, the model predicts that average income will rise in both districts as the 'poorest' of district 2 will move to district 1, where they are in the upper end of the income distribution. However, house prices will go down in district 2, since demand drops as families relocate in the cheaper district 1. Consequently, district 1 will experience increasing house prices. Thus characteristics across districts become more homogenous. (Brunner, Cho, & Reback, 2012)

Implementing school choice program may be a relief for drastic neighborhood segregation, but it will face similar constraints as the original Tiebout sorting in real life. Moving to district 1 presumably increases the distance to the school in district 2. It can be costly in terms of time and money for the family to arrange transportation for their children. Likewise, the relocation to district 1 could complicate commuting. Other constraints may arise if schools have a limit to the number of seats available and cannot expand in demand. In many countries, children living in the catchment area of an oversubscribed school have a priority to those seats. Thus families moving to district 1 run the risk of losing the seat in the highly attaining school of district 2. The effects of school choice on regional segregation are therefore ambiguous but taking everything into account school choice is likely to reduce the link between preferences for local public service provision and residential location. As stated in Brunner et al. (2012) making excludable local public service less excludable will decrease the socio-economic sorting of neighborhoods. (Brunner, Cho, & Reback, 2012) The empirical findings on segregation and school choice are discussed in section 3.

2.3. What Is Driving Segregation of Schools?

There are likely to be certain factors that drive the segregation of schools and probably the most prevalent one is residential segregation (Jenkins, Micklewright, & Schnepf, 2006). Given, for example, a highly segregated city, the segregation of schools is likely to be high as well. Allowing school choice but still giving priority to proximity is not necessarily going to alleviate either residential or school segregation. Other drivers behind school choice listed by Jenkins et al. (2006) are student selection methods and parental choice. Essentially, this means how schools choose their students and how parents choose a school for their children. In school choice systems, where schools are allowed to choose their students either based on previous grades, entrance exams, or socio-economic characteristics, segregation of schools by these attributes is likely to increase. Also, in countries, like in England, choice of school is extremely important for parents (Jenkins, Micklewright, & Schnepf, 2006), which is likely to drive segregation by socio-economic background since parents with similar preferences are likely to have similar characteristics as well. In Finland as well, parent have been reported to go to great lengths to get their children into certain schools or to avoid another school (Helsingin Sanomat 1.5.2011).

One point that is clear from the school choice literature is that private choices have public consequences. Individuals do not consider the public outcomes of their choices. Individual choices on residence, schooling, and leisure, for example, have cumulative effects and they may alter the existing segregation patterns. Small differences in preferences, especially for income level and ethnic group, may lead to serious residential sorting between these groups. However, what has been left to lesser attention is that whether the individual choices are guided by institutional rigidities or inherent preferences for ethnic group and social class. Institutional factors such as discrimination in housing, renting, and job markets or difficulties in getting mortgage guide the choice of residence for people from poor or ethnic backgrounds. On top of this, institutional rigidities that guide the segregation patterns may further influence individual preferences. For example, immigrants are likely to live in areas that are less prosperous and considered unsafe. Characteristics of certain neighborhood are often supposed to characterize the occupants which can create prejudice towards certain groups. These conceptions of certain ethnic group or income level may influence individual preferences and lead to adverse outcomes. This process is likely to be spurious and it might be impossible to separate inherent preferences from institutional factors and to what extent these affect private choices and segregation. (Saporito, 2003)

3. Previous Literature and Research

Critics of school choice have linked the policies to increasing segregation of schools. Accordingly, the first section focuses on the effects of school choice reforms on segregation of schools, and it seems that the studies have mostly found evidence on increasing segregation of schools. It appears that often students are reallocated to groups with their peers at the expense of the lowest achieving students. Whether this has adverse consequences is another matter and not discussed in this thesis. Advocates, on the other hand, have argued that school choice policies may alleviate the pressures of residential segregation in urban areas as families no longer have to move to the catchment area to get their children to the school of their preference. Some studies have found that allowing school choice reduces the link between socio-economic background and residential decisions. Increasing segregation of schools might be followed by decreasing pressure for residential segregation.

What should be kept in mind is that the results on segregation may vary with the school choice scheme implemented, the quality of data, and the empirical method chosen. Of course, the institutional setting and infrastructure differences between countries, and even between municipalities and states, may pose some difficulties when comparing results. Thus it does not come as a surprise that the literature on the subject is somewhat inconclusive and diverse.

3.1. The Effect of School Choice on Segregation of Schools

The studies generally find increasing segregation of schools after the introduction of school choice reform. Allen (2007) studies segregation in the schools of United Kingdom, where school choice was gradually introduced in the 1980s, using a simulation that allocates students to their nearest school, given that there is space, using two-sided priority matching mechanism. His main finding is that segregation in schools would be lower under the proximity based student allocation rule than under the current allocation. Also, under the simulated allocations 61% of socially disadvantaged students would see an improvement in their peer group. This suggests that the low income families are not the main beneficiaries of school choice policies. On the other hand, over 50% of the students are worse off in terms of peer grous under the simulated results. Hence it is not justified to simply claim that proximity based neighborhood school allocation offers a better solution. (Allen, 2007)

In contrast, Makles & Schneider (2011) find inconclusive results on segregation of schools after school choice reform. They study the 2008 primary school choice reform of North Rhine-Westphalia (NRW) in Germany. After the reform, the admission rules still give the highest priority to proximity, like in Finland, and for example admission based on socio-economic background is strictly forbidden. Focusing on the ethnic segregation, Makles & Schneider (2011) conclude that abolishing school districts did not increase ethnic segregation in schools. However, segregation is increasing steadily from 2006, which could be due to other simultaneous policy changes such as new citizenship law. They also compare the NRW municipalities and find that some experienced decreasing while others increasing ethnic segregation. These findings on ethnic segregation are inconclusive but this can to some extent be explained by the fact that most immigrants in Germany are Turkish, and Turkish population is fairly unorganized compared to other ethnic groups. Also, it might take time for families and schools to react to the policy change and they report that the information on school choice possibilities was limited. The data of this study contained only one year after the reform. (Makles & Schneider, 2011)

Regardless of the inconclusive findings of Makles & Schneider (2011) other studies from several countries report significant increases in sorting by ability, income and especially ethnicity in schools after school choice reforms. A little bit closer to home, in Sweden, Söderström and Uusitalo (2010) and Böhlmark and Lindahl (2007) find evidence on increasing segregation in upper secondary and compulsory school level, respectively, after large school reforms. Lindahl and Böhlmark (2007) study the reform that took place in 1992 that introduced private schools and allowed choice between schools. However, proximity in compulsory level is still the main sorting tool. They find evidence on increasing segregation by the education of parents and second-generation immigrant status after the reform. At upper secondary level, reform that took place in Stockholm in 2000 introduced ability based sorting system. Increasing segregation by socio-economic background can largely be explained by ability sorting. However, as Söderström & Uusitalo (2010) demonstrate using the technique introduced by Åslund and Nordström Skans (2009) there is excess segregation by immigrant status that socio-economic background or parents' education cannot account for. Also, findings from UK suggest significantly higher levels of ethnic segregation than income and ability segregation (Burgess, McConnel, Propper, & Wilson, 2007).

Saporito (2003) suggests that out-group avoidance theory could explain increasing ethnic segregation patterns. The theory suggest that segregation outcomes are driven by the preferences of dominant group individuals who avoid schools occupied by those they perceive to belong to lower social status. Minorities are not expected to behave correspondingly. However, whether the preferences of avoidance in school choice are inherent or spuriously based on characteristics that are often linked to neighborhoods occupied by certain ethnic groups remains an open issue. Saporito (2003) supports his view using school choice in his paper to study the effect of individual preferences on segregation. There are less institutional forces and constraints to guide and set boundaries to the individual preferences in school choice than there are for example in making residential decisions. Thus one can isolate the effects of racial composition and school characteristics on school choice decisions made by parents. Analyzing Philadelphia's eight grade students, who filed a magnet school[2] application in 1990, shows that the application patterns vary between different racial groups if the racial mix of neighborhood school increases: choices of non-white families are not linked to racial composition whereas the choices made by white families increase significantly when neighborhood school's racial composition increases. (Saporito, 2003)

Several studies report that school choice behavior is based on observed qualities of a school or its neighborhood rather than actual quality measures that are often unavailable (see for example Kane et al. (2005), Brunner et al. (2012) and Seppänen (2006)). In other words, school choices are mostly based on perceived peer quality. Epple and Romano (2003) consider school choice outcomes and costs of peer group homogenization in different settings. In their simulations they use a two neighborhood setting with public schools, where the neighborhoods and their schools are stratified by

[2] Public schools with weighted curricula or special programs that attract students all over the city in United States are called magnet schools. Magnet refers to the fact that these schools attract students 'like magnets'.

income. If ability is correlated with income, the high income neighborhood school is likely to perform better. School expenditures are assumed equal. In an ideal setting, with no capacity constraints and transportation costs, introduction of school choice will lead to homogenization of peer groups in the schools. Poorest families gain the most as their children will be able to attend a better school. However, the high income neighborhood bears the costs as the average peer quality of their school decreases. They report that in every simulation there were aggregate welfare losses arising from the peer group homogenization. In a more realistic setting with transportation costs, the picture is a bit different: Peer group quality declines in both neighborhood schools as those in the low income neighborhood who can afford the transportation costs will send their child to the high income neighborhood school. Hence in the high income neighborhood school, the average peer group quality will decrease. Those who stay behind in the low income neighborhood school face on average even lower peer group qualities than before. The aggregate welfare losses are higher with transportation costs and are mostly borne by the poorest families as feared by critics. (Epple & Romano, 2003)

3.2. Residential Decisions and School Choice

Studies of residential segregation and school choice policies are usually based on the fact that house prices strongly correlate with school quality. Some of the studies (see for example Machin and Salvanes (2010) and Kane et al. (2005)) have found reductions in the correlation after the implementation of school choice policies. However, the problem is to isolate the effect of school quality on house prices from all the other possible unobserved characteristics of the neighborhood that may have an impact on house prices. The problem is endogenous in nature as families with higher income and presumably higher level of education tend to live with their peers near better performing schools. Residential area near a good school may have more shopping, employment and pastime opportunities, due to more demand and purchasing power. Families with higher income tend to take better care of their house by renovating and decorating. This will further increase the house prices but cannot directly be linked to the quality of the school in the area. A second problem arises from the fact that it is difficult to separate the quality of the school from the quality of the peers at the school. Student outcomes could reflect quality of teaching and facilities in the school or just the quality of the peers in one’s class. (Kane, Staiger, & Riegg, 2005)

One strand on residential segregation research uses boundary discontinuity analysis to isolate the effect of school quality on house prices. Studying house prices near the boundaries of school catchment areas should remove at least some of the unobserved factors that might have an impact on the link between school quality and house prices. However, examination of catchment area boundaries are subject to the above mentioned endogeneity problem due to differential growth over time or other unobserved factors correlated with school quality. (Machin & Salvanes, 2010) Variety of papers try to overcome the problem of endogeneity either by different experimental and methodological design or as Kane et al. (2005) use additional variation from court-imposed desegregation plan in Mecklenburg County, North Carolina between 1994 and 2001. The county redrew school catchment area boundaries several times during the plan to tackle the problem of racial segregation in schools and residential areas. The redrawing of the school catchment area boundaries was unanticipated by the residents so they were unable to react before the redrawing of the boundaries. One of their discoveries is that house prices are systematically different across boundaries and they seem to be reacting to the redrawing of the boundaries. (Kane, Staiger, & Riegg, 2005)

As it seems, school choice reforms provide an interesting framework for studying the effects of school quality on house prices. However, one can flip the set-up and interpret the results from the viewpoint of school choice: did school choice reforms have an impact on house prices and hence on residential segregation? Machin and Salvanes (2010) use rich data from a high school choice reform that took place in Oslo County in 1997. High school admission rules changed from rigid catchment areas to open enrollment. They exploit time-series and cross-sectional variation from discontinuities in neighborhoods caused by the school catchment area assignments. They find that the relationship between school quality and house prices significantly weakens after the reform. However, house price premium does not disappear completely, and they speculate it may be due to transportation costs and persistent pre-reform neighborhood differences. To support their finding, they show that residential mobility has decreased after the reform, indicating reduced pressure to move to the catchment area of a superior school. (Machin & Salvanes, 2010) All in all, one could reason that school choice reform in Oslo has significantly weakened the ‘selection by mortgage’ problem.

Brunner et al. (2012) have similar findings from the US where several states adopted inter-district school choice programs between 1989 and 1998. Their theoretical predictions on districts with better out-of-district school options experiencing increasing average residential income, house prices and population density after the reform are verified by empirical analysis. They conclude that residential sorting is reduced and homogeneity across districts increases after the implementation of inter-district school programs. On the contrary, Brunner et al. (2012) do not find reductions in residential mobility after the reform like in Oslo. Instead, families who previously resided in a district with better quality schools seem to be relocating to cheaper districts as predicted by the theory, hence increasing the average residential income, population and house prices in the cheaper district.

Burgess et al. (2007) study the effect of school choice in UK on the sorting of students in secondary school according to three dimensions: ethnicity, income and ability. They use the variation created by the feasibility of choice and admission rules that may differ substantially between LEAs[3]. Using variation between LEAs, they compare the segregation in schools to neighborhood segregation and find that in areas, with great number of schools to choose from, school segregation is substantially higher than neighborhood segregation. The link between school and neighborhood segregation is weakened if LEAs use ability based student assignment rules. Similarly, Söderström and Uusitalo (2010) compare residential and school segregation in Stockholm and find that segregation of schools increases faster than residential segregation. However, the upper secondary school reform in 2000 did not undo residential segregation, as it increases steadily throughout the observation period (and even before the reform).

4. Finnish Comprehensive Schooling System and School Choice

4.1. General Information

The Finnish comprehensive schooling system consists of nine years of education. Generally schools either teach grades one to six (primary level) or grades seven to nine (intermediate level). Although, formally there does not need to be a division into stages and there exists several schools that offer grades one to nine and some may even offer grades from three to nine. Thus there are several stages in comprehensive school when students can exercise choice and apply to another school.

[3] Local Educational Authorities

Education in Finland is compulsory and free for everyone. Generally, students start their education the year they turn seven and end the year they turn 16. Students are obliged to stay in school for ten years after they have entered the schooling system. In other words, if a student started comprehensive school at age seven and has not finished at age 17, the student is exempted from comprehensive schooling. However, there have been discussions on raising the age when one is exempted from the comprehensive school.

Nowadays, education is mostly provided by municipalities and only 2% of students attend either private non-profit schools or centrally organized schools[4]. Central government provides loose guidelines for curriculum and subsidies to municipalities to organize their education. Municipalities are hence relatively autonomous in their educational decisions, and can, for example, decide on the financing of schools and number of schools providing weighted curriculum.

The main tool for student sorting is proximity and generally municipalities have decided on catchment areas for each school, though the practices can differ considerably between municipalities. Today, students are allowed to apply to another school but the ease of applying and being accepted into other than your assigned school varies between municipalities (Seppänen, 2006). Schools are not simply allowed to expand given extra demand, and hence remain capacity constrained.

The reform popularized weighted curriculum and special grades whose intake area can be the whole municipality and they are nowadays quite common in bigger cities (Seppänen, 2006). Schools of today can offer a variety of programs from music to even golf and ice hockey. Some of these schools with weighted curriculum have aptitude tests to select their students but selection should not be based on previous grades. In oversubscribed schools, without any special programs, the selection of students from outside the catchment area is based on lottery.

(Finnish National Board of Education)

4.2. The School Choice Reform

In many countries, including Finland, school choice was part of the government decentralization process that started in the 1980s. In Finland, school choice was

[4] Schools run by government

introduced to the current comprehensive schooling system gradually during the 1990s as a result of several small policy changes. Before, student sorting was mainly based on rigid catchment areas according to which students were assigned to their neighborhood schools. (Seppänen, 2006) The driving force of school choice seems to have been schools with weighted curriculum or special classes that are no longer bind to strict catchment areas (Turun Sanomat 30.5.2013) and (Bernelius, 2013).

School catchment areas were introduced already in 1898 and municipalities were obliged to provide schooling for everyone, however, education was not compulsory until 1921. The 1921 law for compulsory education permitted students to attend schools outside their own catchment areas but this came to an end after a policy change in 1946. (Seppänen, 2006) Before the comprehensive schooling system reform, Finnish schooling system had two parallel paths students could follow after 4 common years in primary school (suom. *kansakoulu*). At the age of 11, students applied to either secondary school (suom. *oppikoulu*) or continued in primary school. Admittance to secondary schools was based on entrance examination, previous grades and teacher assessment. Only the educational path of secondary schooling allowed students to continue their studies at university level. Most of the secondary schools were private, and funded by state aid and fees collected from students. (Pekkarinen, Uusitalo, & Pekkala, 2006)

The comprehensive schooling system reform took place in the 1970s. It abolished the parallel educational paths and private schools. As an alternative, the reform introduced a nine year comprehensive school that is common to all. The reform prohibited schools from choosing their students, unless a school was providing special teaching duty such as music. Until to the end of 1980's, opting out from one's own neighborhood school was rather difficult. Even though school choice was not exactly forbidden and students were allowed to apply to other schools in special cases[5]. However, like today, school size was limited: schools could only intake the amount assigned to them by their catchment area which essentially limited school choice possibilities. (Seppänen, 2006)

The 1970s reform promoted equal educational opportunities for all but during the 1980s Finland underwent a series of small policy changes aimed at decentralizing government administration. During the late 1980s, government of the time made a proposal for the

[5] Students were required to have a special reason or a medical issue. (Seppänen, 2006)

development of education that promoted more options and individualism in education. As a result of the early 1990s policy changes, Finnish municipalities gained more power and could influence the provision of education. Strict guidelines for curriculum were removed in 1994 and municipalities were allowed to set their own curricula. These changes led to more schools providing weighted curricula and special teaching programs. Furthermore, state aid was no longer tied to the division into catchment areas. Essentially, these changes led to the gradual introduction of school choice in the biggest cities of Finland in mid-1990s. Even though, school choice was made more formal in 1998 Education act that no longer required strict catchment areas and allowed aptitude tests for special educational programs. However, municipalities are still required to offer students a place in their neighborhood school but students can opt out and apply to another school. (Seppänen, 2006)

4.3. Motivation and Critique

In many countries school choice has been a controversial and heatedly debated subject, whereas in Finland the introduction was made mainly in consensus and only a handful of questions were raised at the time. The Finnish case differed in other aspects as well from its international counterparts. In many other countries, the debates revolved around possible gains from competition and drawbacks from segregation outcomes. In Finland, on the other hand, the motivation behind school choice was rather simple: it enabled schools to provide special teaching programs and weighted curricula which were believed to inspire children. (Seppänen, 2006) Even if it was not brought up at the time school choice was introduced in Finland, better matching of students and schools is usually believed to improve student outcomes (Hoxby, 2006). Similarly, advocates of school choice did not bring up the possibility of improving quality of education via competition between schools. Indeed, it seems that the fact that parents would choose a school based on quality of education was not even acknowledged at the time. Also, the possible influence school choice could have on residential segregation did not come up in the public discussions. The Government Institute for Economic Research was probably the only one to suggest that school choice could alleviate the pressures of ‘selection by mortgage’ in urban areas. In general, policies leading to school choice in Finland were rationalized mainly by the importance of differentiation. (Seppänen, 2006)

However, few years after the introduction of school choice in bigger cities, critics announced their concerns. The critique in Finland followed quite closely the conversations that had already taken place in other countries. The main fear in Finland has been that school choice would wreck the 'common to all' comprehensive schooling system and no longer provide equal learning opportunities, and recently the director general of the Finnish National Board of Education suggested limiting school choice (see Liiten (2012)). The critics believe school choice favors talented children that generally come from wealthier backgrounds. Educated parents seem to have more knowledge on school choice and are more likely to send their children to schools with weighted curricula. Eventually, this could lead to segregation of schools by socio-economic background where some schools are valued highly and others rejected by wealthier and more educated families. Children from poorer backgrounds are left to rejected neighborhood schools and only a few seem to opt out and apply to another school. (Seppänen, 2006) If peer groups are expected to affect student outcomes, increased segregation of school would imply less equal education provision (Söderström & Uusitalo, 2010). In other words, students with higher achieving peer groups will benefit at the expense of students at rejected schools with less able peer groups, given that peer group effect exists (see for example Katz et al. (2001) on peer group effects).

The critique is in many ways valid, but it fails to acknowledge some essential factors. It does not generally take into account the alternative: the possibility that without school choice well-off families would 'vote with their feet' and move to another part of the city with attractive and high attaining schools. As described in section 2.3, areas with highest segregation of schools are likely to have higher residential segregation, indicating that school segregation is likely driven by the underlying residential segregation. There is a possibility that banning school choice *ceteris paribus* could lead to higher residential segregation on top of the segregation of schools. Also, student sorting, in its current form, is still mainly based on residence and not on previous grades as in many other countries. Hence, in general, the expected effects of school choice on student outcomes[6] and segregation are likely to be small. Of course, the use of aptitude tests in schools with weighted curricula can increase sorting by ability, but since the

[6] If schools are allowed to select their student and 'skim the cream', segregation of schools is likely to be higher (Jenkins, Micklewright, & Schnepf, 2006).

special teaching programs range from sport to sciences, the effect is likely to be small. Nonetheless, some of the students may apply for special educational programs already as early as in primary school, and Finnish critics have expressed their concern for students choosing their career paths too early in their studies (Seppänen, 2006).

Another issue is that in many countries, like in Finland, government regulates quantities but provision of education is decentralized and local municipalities and authorities are responsible for organizing it. In Finland, schools have loose guidelines for curricula and are thus able to independently decide whether to provide weighted curriculum and specialize for example in sciences or sports. These schools can compete for gifted and motivated students by the provision of the weighted curricula. However, schools are not able expand their supply by entering or creating new student places in popular schools. Namely, schools are not rewarded (punished) for doing well (bad). School choice in this kind of setting might not generate general equilibrium improvements suggested by Hoxby (2006) (see section 2.1) and is likely to reallocate students to groups with their peers at the expense of the lowest achieving students[7]. In other words, the system in Finland is unlikely to lead to improvements in school quality that would benefit all. Nevertheless, like the original motivation behind school choice in Finland suggested, the current system, driven by weighted curricula, is likely to increase school satisfaction and motivate children, at least among those who have exercised choice.

5. Data

5.1. Data

The data contains all the students from ninth grade and all others who have applied in the joint application system. In the joint application system, one applies to secondary studies (i.e. high school or vocational studies). Since this analysis focuses on comprehensive schools and ninth graders, all other applicants are removed by the grade they are in and graduation year, which should be the same as the application year. Furthermore, some of the students appear several times during the years of observation, some have even graduated several times from ninth grade (i.e. they have redone ninth grade), but only the first observation is taken. I have also removed students who do not

[7] Since students with higher socio-economic background are more likely to be choose their school (Seppänen, 2006).

have or have a faulty comprehensive school code in the data. This means that there are around 63 000 ninth graders in the data each year.

The data contains all the ninth graders even if they did not apply to secondary schooling. However, only address and school at ninth grade can be observed for them and there is no information on GPAs. Some of these dropouts apply to secondary education year or two after they have first appear in the data, and in some cases they appear with their grades from the same ninth grade they graduated in the first place (i.e. they have not redone ninth grade or graduated from tenth grade). I have retrieved these grades if the school and the graduation year have stayed the same as in the first observation using data up to 2012. Only about 600 missing GPAs could be retrieved from the total 10 000 missing ones. Every year around 1.8% of the students seem to dropout from secondary schooling. However, it is likely that some of these students applied abroad: international schools with above average school GPAs and schools in Åland Islands have the highest dropout rates. Also, some of the schools have special grades for students with learning disabilities, which would explain high dropout rates in otherwise well-doing schools. I have decided to keep all the schools in the analysis since these things may have an impact on segregation of schools.

I have combined the joint application data to matriculation examination data using social security number. The matriculation examination dataset runs from early 1990s to 2012 and contains information on the grades, exams and the ‘occasion’ of the exam (*suom. kokelaslaji*). There is no information on graduating high school and hence using the occasion of the exam and the information on grades, I am able to determine whether one has in fact graduated from high school (*suom. kirjoittanut ylioppilaaksi*). The occasion of the exam tells for example if the exam is a retake to increase the grade or to pass the exam, or if the exam does not aim at completion of the high school at all. Four mandatory exams must be passed during three semesters. However, if student fails at one or more of the exams, three extra semesters are allowed to pass the failed exams. (Tampereen aikuislukio) Using all of this information, I have constructed a high school graduate dummy. Still, the dummy might not be 100 % accurate due to possible special cases that cannot be observed from the data.

The school and student addresses are geocoded from addresses to coordinates using Gpsvisualizer's geocoder[8] that uses Bing maps as a source for the coordinates. However, I noticed that the geocoding becomes inaccurate when coding several addresses. These inaccuracies should not affect the results, since the bias is likely to be the same for each year. I also checked if the student's addresses are within a sensible distance from the center of the municipality in cities. These unlikely addresses were not used to calculate the average distance to school. Also, if the distance to school exceeded 30 km in Helsinki (50 km in smaller municipalities), it is likely that either the address is incorrect or the student has moved. The latter is quite likely, since students make their school choice in seventh grade but appear in the data at the end of their ninth year. These addresses are also excluded from average distance to school calculations.

The following descriptive details of the data mostly concern the capital city area and similar measures for ten other cities are available in Appendix 1 Descriptive Statistics.

5.2. Descriptive Statistics from Capital City Area

Due to the nature of the gradual introduction of school choice and the autonomy of municipalities in educational decisions, there is no clear point in time for the beginning of school choice for any of the municipalities in Finland. The data starts from 1996, meaning that students who graduated from ninth grade in 1996 started seventh grade in 1993. The ten biggest cities in Finland started school choice, and some even actively promoted it, in mid-1990s (Seppänen 2006). This means, that there could be at least one year before any 'official' introduction of school choice.

On the other hand, the small policy changes in the beginning of 1990s allowed schools with weighted curriculum or special grades to select students from outside their own catchment area. Furthermore, these special schools started to become more popular in the course of the reform. This poses some difficulties, as it is likely that students exercised choice even before the mid-1990s at least in Helsinki. To support this, in the first official school choice year in Helsinki in 1994 already third of the students applied to other than their neighborhood school (Seppänen 2006). However, school choice is likely to be a gradual process (Söderström and Uusitalo 2010) and it is unlikely that any of the cities would have experienced any sudden jumps in school choice activity. This is

[8] http://www.gpsvisualizer.com/geocoder/

also supported by the figures of average distance to school and share of students attending local school. Average distance to school is likely to grow if students are allowed to attend other than their nearest school. Also, clearly the share of students attending their local school is going to drop.

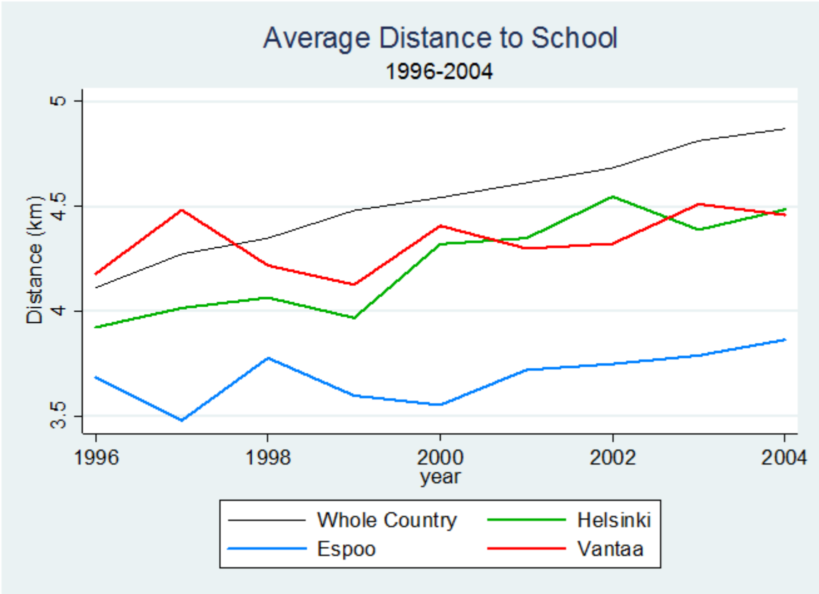

Figure 1 The development of average distance to school in the capital city area between 1996 and 2004 measured using joint application data of all ninth graders between 1996 and 2004

There seems to be gradual growth, but no clear jumps, in the average distance to school in Helsinki and Espoo. There is some movement in Vantaa as well, but no clear growth. Vantaa has taken a stricter stand in school choice and in this sense the average distance to school should not experience significant increases. Although, even Vantaa experiences some, but very gradual, decrease in the share of students attending their local school (figure 3).

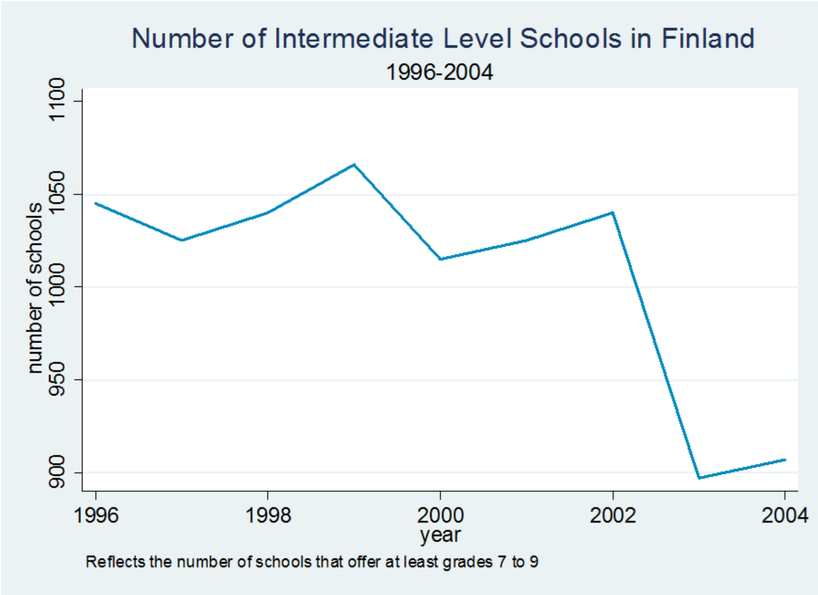

Figure 2 The development of the number of comprehensive schools offering (at least) grade 9 in Finland between 1996 and 2004 measured using joint application data of all ninth graders between 1996 and 2004

Some of the growth in the average distance to school evidently comes from the fact that the number of comprehensive schools in Finland decreases by over 100 schools during the period of 1996 to 2004. However, in the capital city area, the number of schools stays quite steady through the nine years (table 6, Appendix 1 Descriptive Statistics).

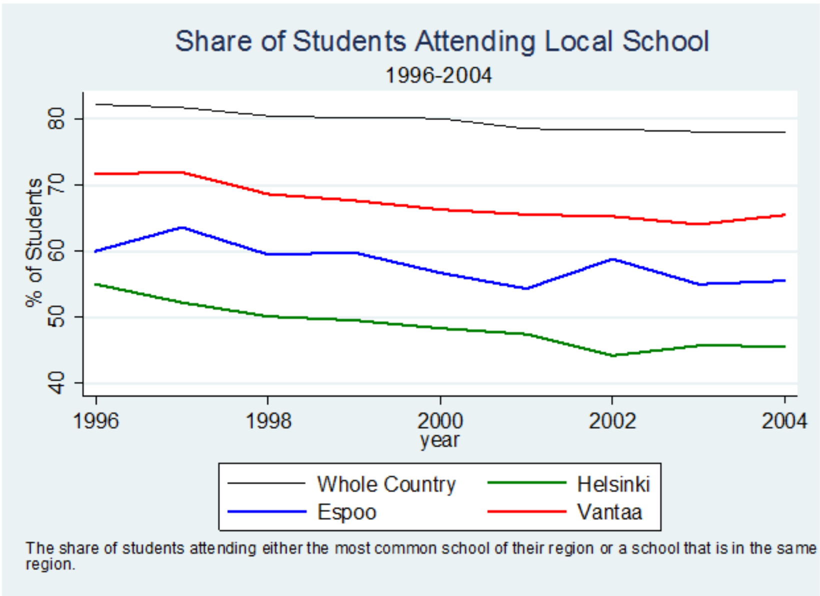

Figure 3 The development of the share of students attending their local school in the capital city area between 1996 and 2004 measured using joint application data of all ninth graders between 1996 and 2004

Since I do not have the catchment areas for each school and year, I calculate the share of students that attend a school in the same region as they reside. The regions are defined by postal codes. If, however, there is no school in the same region, I check whether the student attends the most common school of the region. This method might not be the most accurate one, but will capture the decreasing trend in local or neighborhood school attendance described by Seppänen (p. 161, 2006) amongst others. Figures for ten other municipalities can be found in the Appendix 1 Descriptive Statistics.

There is no clear pattern in the average GPA for any of the municipalities, but if segregation is assumed to increase this should be visible when comparing the distributions of GPAs from year to year. The next figure illustrates differences between the first and the last observation year in Helsinki and Vantaa. I have drawn a normal distribution to the figures to help to illustrate the change in the distributions. There seems to be very little change in the distributions of Vantaa between the years, indicating no or very little change in segregation. However, as can be seen from the comparison of the distributions in Helsinki, the tails become slightly heavier in 2004: there are more extreme grades. This would indicate a growth in segregation by GPA between the years.

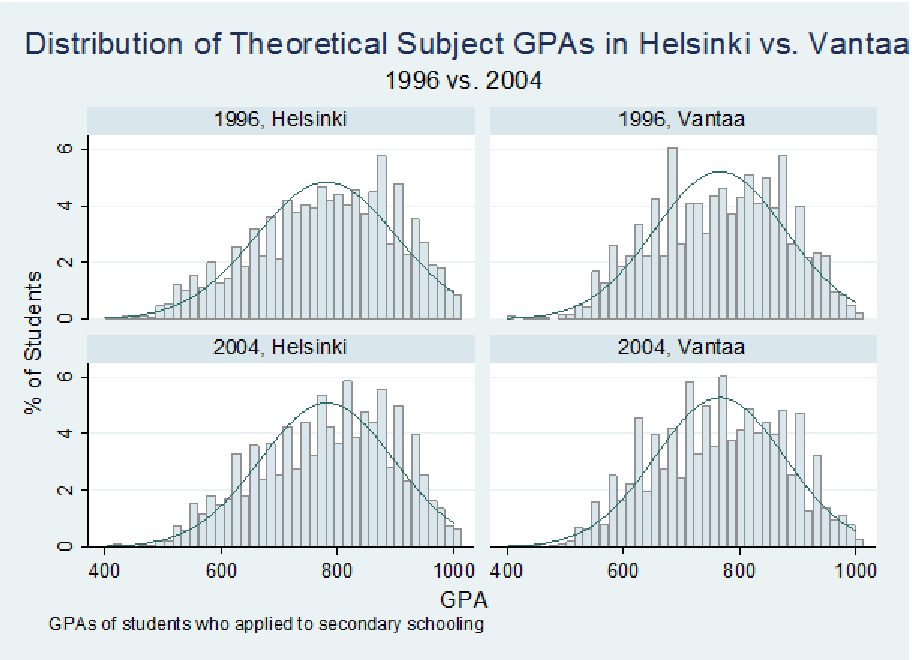

Figure 4 Distribution of the ninth graders' GPAs of theoretical subjects in Helsinki vs. Vantaa in 1996 vs 2004 against normal distribution curve measured using joint application data of all ninth graders between 1996 and 2004

As described, I have combined the data with matriculation examination results. Thus I am able to determine whether students have graduated from high school. The following two figures (5 and 6) clearly show the differences between the capital area cities. All of the cities experience a little drop in the share of students completing (figure 5) and attending high school (figure 6), especially Vantaa. Figure 5 might be explained to some extent by the fact that students from mid-1990s have had more time to take matriculation examinations as students who finished ninth grade in the 2000s. Not all attend high school straight after ninth grade and some might acquire other degrees or professions before they even consider completing high school. I am guessing that the share of students combining vocational studies with matriculation examination has increased in the 2000s, which would explain the even clearer drop in the share of students attending high school straight after ninth grade (figure 5). Also, Capital City Area, like most of the biggest cities (excluding Jyväskylä), experiences growth in the number of students attending their schools (table 8 Appendix 1 Descriptive Statistics). This might have an impact on both the share of high school graduates and the share of students attending high school straight after ninth grade. These rates for 13 municipalities studied in this thesis can be found in Appendix 1 Descriptive Statistics tables 10 and 11.

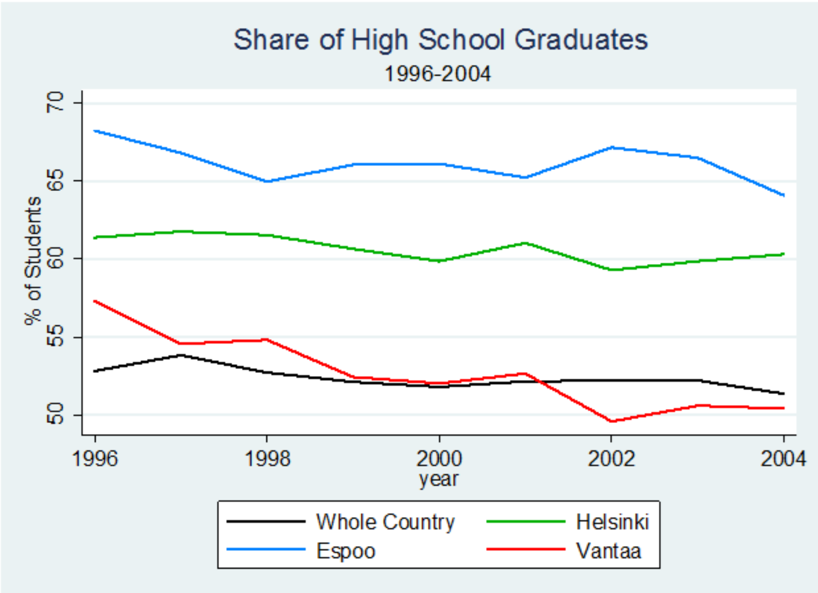

Figure 5 The development of the share of ninth graders who eventually finish high school/matriculation examinations between 1996 and 2004 in capital city area measured using joint application data of all ninth graders between 1996 and 2004 and matriculation examination data from 1990s to 2012

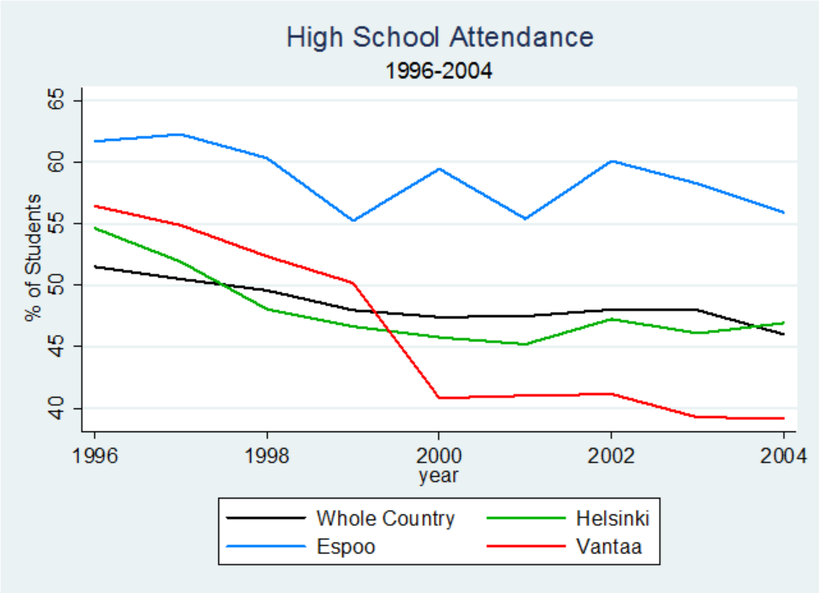

Figure 6 The development of the share of students who attend high school straight after finishing ninth grade between 1996 and 2004 in capital city area measured using joint application data of all ninth graders between 1996 and 2004

The share of foreign speaking students increases in the whole country during the period and especially so in the biggest cities. Figure 7 below illustrates the growth in capital city area: Vantaa experiences the most dramatic growth in the share of foreign students. Shares for ten other municipalities are available in table 9 in Appendix 1 Descriptive Statistics.

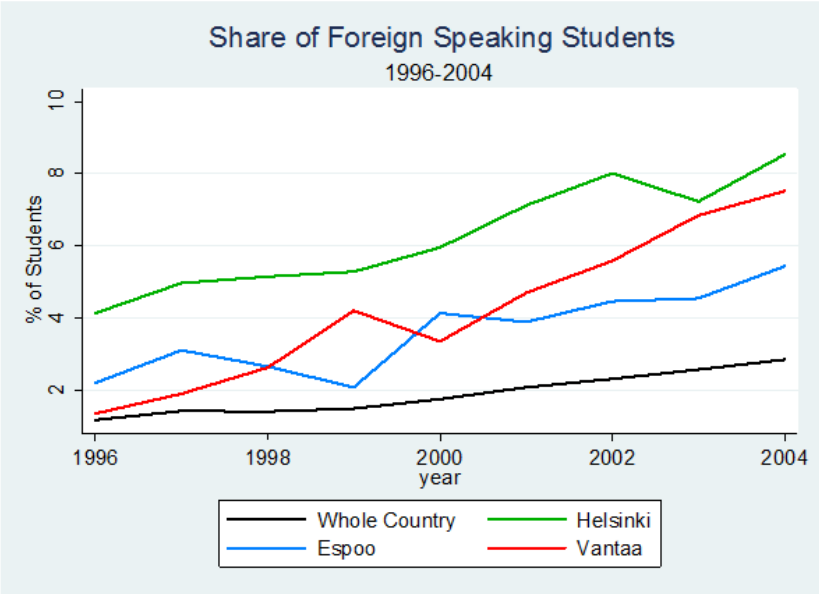

Figure 7 The development of the share of foreign speaking students of ninth graders in the capital city area between 1996 and 2004 measured using joint application data of all ninth graders between 1996 and 2004

5.3. Schools from Helsinki as an Illustrative Example

Helsinki represents a special case as the diversity of special educational programs provided, especially at intermediate level, is much higher and commuting possibilities much better than in the rest of the country. Thus it is not a surprise that school choice is very popular. Already in 1994, almost 30% of students applied to other than their neighborhood school in Helsinki, and the number has increased steadily through the years (Seppänen, 2006). Today, only 40% of the students attend their neighborhood school (Turun Sanomat 31.3.2013). There are number of special schools that use the whole of Helsinki as their catchment area and are thus not constrained by capacity issues to same extend as most schools where students living nearby have a priority. However, some of these programs require aptitude tests. Thus, I expect there to be evidence on student sorting by ability and dispersion of schools.

If segregation of schools has indeed increased, some schools should perform better than before and some worse. To illustrate this I compare ninth graders of four different schools in Helsinki and show how average GPAs, shares of foreign speaking student and high school graduates develops during the nine years. This will show how schools that started from quite similar features start to separate. However, it does not represent the overall picture in Helsinki: in most of the schools, grades and high school attendance did not experience any dramatic changes or there are fluctuations from year to year. These schools are just picked for illustrative purposes. What should also be kept in mind is that some of the schools studied here might have started, or already had a weighted curriculum or special grades during the observation period. Other factors, such as school closures or new catchment areas might drive the development and hence at this point it is impossible to draw any conclusions on the possible reasons behind the separation of these schools.

Starting with schools' average GPAs of theoretical subjects, where in the first year, 1996, schools B, C and D have average GPAs very close to each other. In the end of the period, school B is closer to the high attaining school A whereas C's and D's performance seems to be fallen.

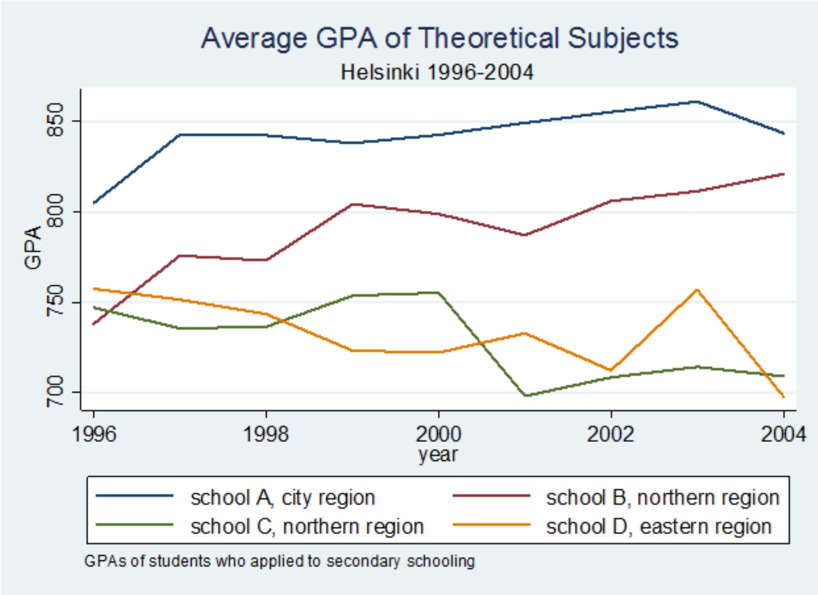

Figure 8 The development of four schools' average GPAs in Helsinki between 1996 and 2004 measured using joint application data of all ninth graders between 1996 and 2004

Similar development patterns are observable from the figure below, which describes the development of the percentage of schools' ninth graders who eventually pass matriculation examination and graduate high school. School B separates from schools C and D and eventually catches up with school A.

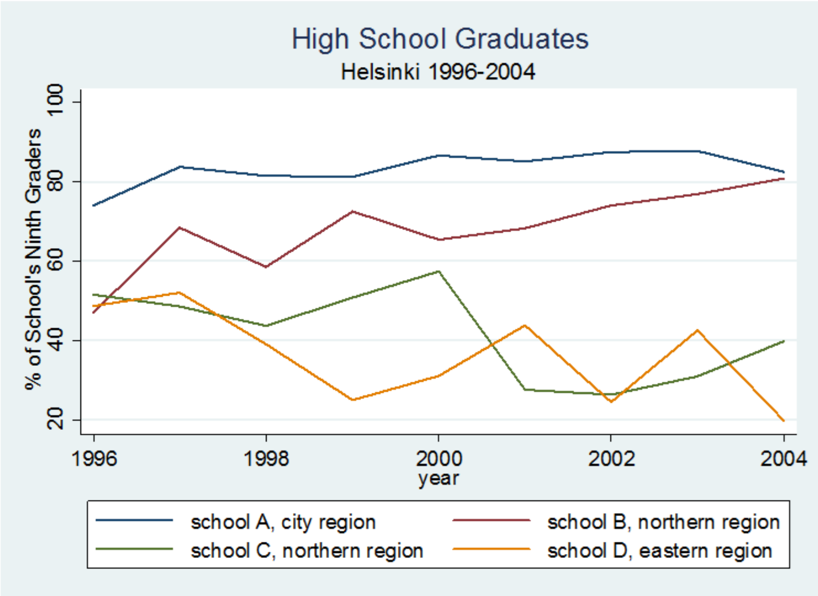

Figure 9 The development of the share of high school graduates of four schools' ninth graders in Helsinki between 1996 and 2004 measured using joint application data of all ninth graders between 1996 and 2004

The next figure is interesting and describes the share of foreign speaking students. As mentioned, the share of foreign speaking student increases quite dramatically in

Helsinki during this observation period but these students are not distributed evenly across schools as shown by the next figure.

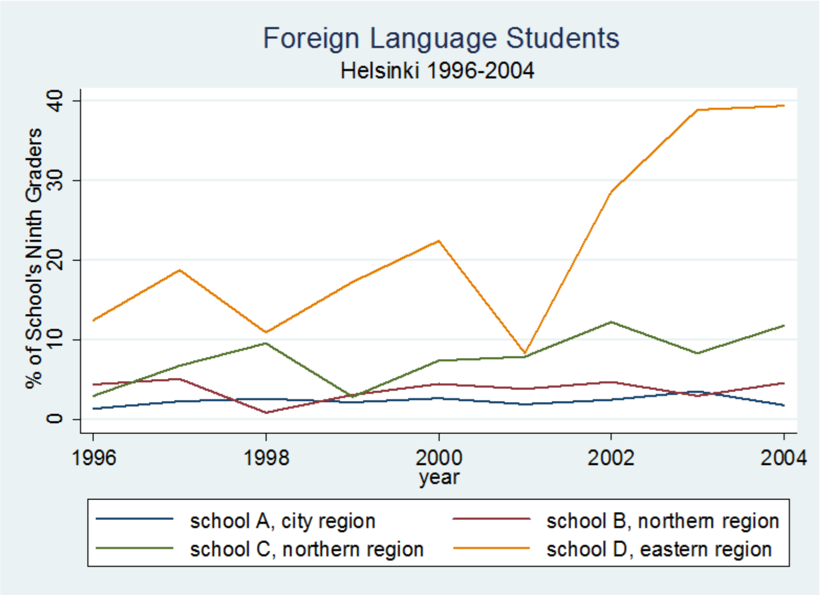

Figure 10 The development of the share of foreign speaking students of the ninth graders of four schools of Helsinki between 1996 and 2004 measured using joint application data of all ninth graders between 1996 and 2004

Since the data contains all the students from ninth grade, I am able to calculate dropout rates for the schools. However, in this thesis the term dropout does not necessarily mean that student is left without further education: student might attend tenth grade, repeat ninth grade or apply to study abroad. The dropout rates follow quite similar patterns for the other three schools, but for school D it explodes towards the end. It is most likely due to the share of foreign speaking students, but whether they complete their education in another country or attend tenth grade is another matter. Nevertheless, foreign speaking students are over-represented in the share of school dropouts in the sense that they do not pursue any further education after completing comprehensive school (City of Helsinki, 2012).

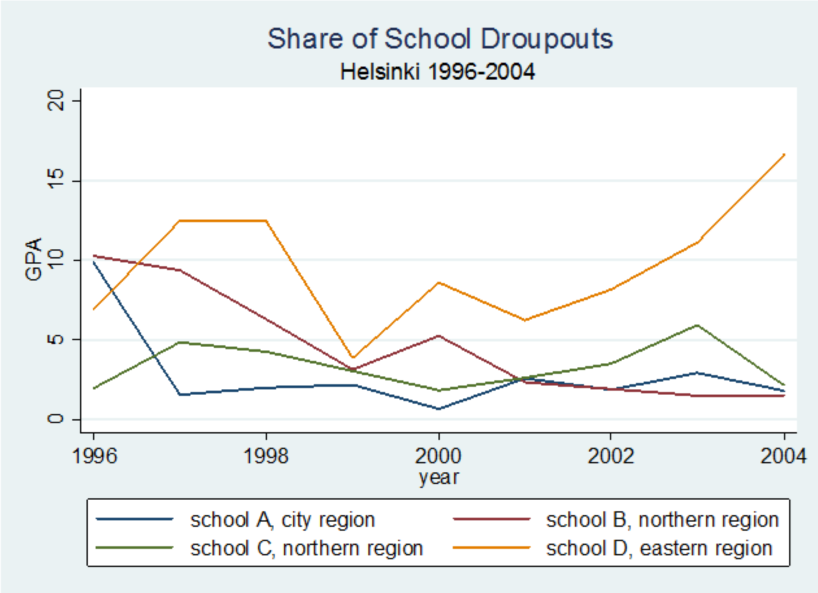

Figure 11 The development of dropout rates of four schools of Helsinki between 1996 and 2004 measured using joint application data of all ninth graders between 1996 and 2004

6. Methods

6.1. Segregation Indices

6.1.1. Dissimilarity Index

The dissimilarity index, or commonly called Duncan index after Duncan and Duncan (1955), compares the distribution of two mutually exclusive groups in an area. It describes how equally the groups are spread across a certain area over some entities, such as schools or jobs. It takes values from zero to one. The best way to understand the measure is to think it as the proportion of people in either group that should change their residence/school/job to offset the segregation. It takes the value zero when the groups are equally dispersed and one when there is total segregation i.e. none of group A resides in same area with group B residents. These are however, theoretical measures and unlikely to occur in real urban setting. (Duncan & Duncan, 1955) The dissimilarity index defined by Duncan and Duncan (1955):

$$D = \frac{1}{2}\sum_{i=1}^{n}\left|\frac{a_i}{A} - \frac{b_i}{B}\right| \tag{1}$$

Where N is the number of entities (i.e. schools/jobs), A and B are the number of individuals in group A and B, correspondingly and a_i and b_i are the number of individuals that belong to group A or B, correspondingly, in entity i (i.e. school i).

However, the index has its limitations and has raised concerns early on by various researchers. First of all, the index can only be used to compare two mutually exclusive groups, such as whites and non-whites. Thus, it cannot be used in the case of continuous variables, such as grades, unless converted into binary variables. This means that measuring segregation by grades must be done with a different method.

Secondly, according to Cortese et al. (1978) in their reply to Massey, the index of dissimilarity, Duncan index, is inaccurate when comparing, for example, measures from two cities with fairly different proportions of the minority groups. Similarly, if the share of the minority group changes, the index will pose problems when comparing the same city over time (Cortese, Falk, & Cohen, 1978). Taeuber and Taeuber (1988) demonstrate this problem with two cities, Los Angeles and Washington DC. The residential segregations in these cities are equal even though the distributions of black and white are nearly reversed. Regardless of its limitations, it is still very widely used even in modern day research.

6.1.2. Variation between Schools

The coefficient of determination has a simple interpretation, like Duncan Index, and is intuitive to economists. I use the variation that can be explained by the schools attended, R^2, to explain the variation in grades, as well as in other variables, caused by the schools. It takes its maximum value one, when the variation in grades is totally explained by the schools attended and when the schools do not have anything to do with the variation in grades, R^2 takes the value zero. It does not suffer from similar drawbacks as the Duncan Index.

6.1.3. Isolation Index

The modern version of Isolation index measures the probability that randomly picked member of a minority group meets another member of the same group in the same area. Conversely, the index can be interpreted as the probability of randomly picked minority group member not meeting a member of the majority group locally (i.e. in the same area/school/job). (Simpson, 2007) The index can be used to compare more than two groups, but not in the case of continuous variables. Simpson (2007) uses Lieberson's definition of the isolation index:

$$S = \sum_{i=1}^{n} \left(\frac{a_i}{A}\right)\left(\frac{a_i}{n_i}\right) \tag{2}$$

where a_i is the proportion of the minority group in entity i (i.e. school), A is the total number of individuals in the minority group across all the entities and n_i is the number of all individuals in entity i (i.e. the number of students in school i). Simpson (2007) describes the index as being *"a proportion within the local population, averaged across all members of that group"*.

However intuitive the interpretation of the index, the range of values it can take is somewhat problematic: The upper bound is familiarly one, describing full segregation and all members of the minority group are located in the same area/school/job without any members of the majority group. In other words, there will only be members of the same group in each area/school/job. The lower bound is $\frac{A}{N}$, the proportion of minority group from the total population. The index is therefore dependent on the overall composition of the population, which causes problems when the share of the minority changes over time or differs between cities. (Simpson, 2007) The probability of meeting other members of the minority group will most likely increase if the share of minority individuals from total population increases (Vilkama, 2011) even though segregation in itself may stay unaffected.

One solution is to standardize the isolation index to take values from zero to one, making it fully independent of the composition of the population (Simpson, 2007):

$$S_{stand} = \frac{\sum_{i=1}^{n} \left(\frac{a_i}{A}\right)\left(\frac{a_i}{n_i}\right) - \frac{A}{N}}{1 - \frac{A}{N}} \tag{3}$$

However, after standardization the interpretation of the index is no longer as straightforward but will still be useful in determining whether segregation has increased over time (Vilkama, 2011).

I use isolation index only to measure the segregation of schools by foreign speaking students since Duncan index becomes inaccurate when the share of foreign students is small and increases over time. Also I believe the isolation index is more intuitive and informative when the share of the minority of total population is quite small.

6.1.4. Segregation from Randomness

The segregation indices described here measure segregation from evenness. However, as Söderström and Uusitalo (2010) note, segregation is unlikely to be zero even if individuals were randomly allocated across schools (or other entities). Random allocation is unlikely to result in evenness particularly if, for instance, the share of minority or the size of entities (i.e. schools) is small. This is likely to cause problems as the aim of the segregation indices is to answer whether there is any systematic sorting of individuals across entities (Åslund & Nordström Skans, 2009).

I follow the method described by Carrington & Troske (1997), to modify the segregation indices to account for random variation. Indices are adjusted by subtracting the expected segregation from the actual segregation and scaling it back to range from zero to one:

$$\hat{Z} = \frac{Z - E(Z)}{1 - E(Z)} \tag{4}$$

Expected segregation, E(Z), is calculated by randomly reallocating students to schools, keeping number of schools and their size fixed. Segregation indices are calculated from this randomly reallocated data and this is repeated 500 times for each year and municipality. The mean of these replications will be the expected segregation index.

My results show that some of the expected segregation indices are quite substantial, suggesting the importance of adjusting the indices to measure deviation from randomness rather than evenness. The adjustment scales down the segregation indices and in some case they are close to zero or even negative.

6.2. Bootstrapped standard errors

To evaluate the variance in the sampling distribution, I calculate bootstrapped standard errors for the segregation indices. The process involves randomly drawing, with replacement, n schools from the original data. Where n is the number of schools per municipality per year. In each draw, I calculate the segregation indices. This process is repeated 500 times for each year and municipality. Standard errors are calculated from the repeated calculations of the segregation indices.

Potential problem arises from the adjustment of the segregation indices to measure segregation from randomness rather than evenness. If E(Z), the expected segregation index, is a constant, there is no problem in adjusting the indices and the bootstrapped standard errors. In theory, E(Z) should be constant since students are allocated to schools randomly (and repeatedly), eliminating the possible dependence between student outcomes and schools. I tested this by calculating bootstrapped means and standard errors for twenty different random allocation segregation indices. Although, I only repeated the bootstrapping 50 times, the bootstrapping did not significantly alter the segregation measures in any of the 20 cases. Hence, I am confident in using the adjustment in the segregation indices and their bootstrapped standard errors.

6.3. Fixed Effects Model

The gradual introduction of school choice makes it difficult to come up with a clear setup to identify possible causality between school choice and segregation. For a differences-in-differences setting, more data from before the reform is required to create a clear before and after situation and follow the before reform trend. However, by exploiting the repeated observations on the segregation indices from all the municipalities with at least two schools[9], fixed effects model can be used to identify the effect of school choice on segregation.

In panel data, there are observations on several entities at different times. Hence one can exploit both the across-entity and within-entity variation. Running regressions with observations across entities at only one time point runs into risk of having omitted variable bias. This means that there could be unobserved factors that could be correlated with the independent variables, causing bias in the estimates. But with several time points, the across entity factors (i.e. differences between cities) that might cause omitted variable bias cancel each other out if they are time-invariant. This is the identifying assumption behind the model.

[9] At least two schools are required in order to meaningfully measure segregation indices.

I intend to measure how the share of students attending other than their local[10] schools impacts the segregation measures. Since I do not have the catchment areas for the schools, as explained in section 5.2, I use the local school attendance share to proxy the share of students who have exercised choice. The municipality fixed effects model is define as:

$$\hat{Z}_{mt} = \alpha_m + \beta L_{mt} + \varepsilon_{mt} \tag{5}$$

Where $\hat{Z}_{mt}$ is the adjusted segregation index at time t and municipality m, α_m is the municipal specific intercept, β tells the impact the share of students attending local school at time t and municipality m, L_{mt}, has on the segregation index and ε_{mt} is the error term.

The identifying assumption is that there are no unobserved factors that change over time that could impact the share of students attending local school (and possibly segregation of schools). For example increasing residential segregation might have an impact on the share of students exercising choice: i.e. a student from bad neighborhood in a heavily segregated city might want to apply to a school in better parts of the city with seemingly better quality peers. Residential segregation is likely to drive the dispersion of schools if the primary method of student sorting is residence based (Jenkins, Micklewright, & Schnepf, 2006), as it is in Finland. Hence, it is likely that residential segregation could cause omitted variable bias in this model.

Adding a measure of residential segregation that has been measured along similar lines using postal codes rather than schools as entities to the model, should account for the possible bias. The model transforms into:

$$\hat{Z}_{s_{mt}} = \alpha_m + \beta_1 L_{mt} + \beta_2 \hat{Z}_{r_{mt}} + \varepsilon_{mt} \tag{6}$$

Where $\hat{Z}_{s_{mt}}$is the segregation measure of schools, α_m the municipal specific intercept, β_1 tells the impact the share of students attending local school at time t and municipality m, L_{mt}, has on the segregation index. β_2, on the other hand, describes the effect residential segregation, $\hat{Z}_{r_{mt}}$, at municipal m and time t, has on the segregation of schools and ε_{mt} is the error term.

[10] Student attends local school, if the school is in the same postal code area or if it is the most common school of the region.

Dummies for time can be added to the model to capture the possible changes in the municipal specific intercepts between the years:

$$\hat{Z}_{s_{mt}} = \alpha_m + \beta_1 L_{mt} + \beta_2 \hat{Z}_{r_{mt}} + \delta_1 Y_1 + \cdots + \delta_{n-1} Y_{n-1} + \varepsilon_{mt} \quad (7)$$

Where everything else is the same as in equation 6, and δ_i is the coefficient for the time dummy for year i, Y_i. In case, there is data for n years, n-1 time dummies are added. In my model, I have data on 9 years and omit the first year. (Angrist & Pischke, 2009)

On possible problem arises, as the share of students attending local school might be endogenous in nature. There exists a possibility of reverse causality, where high segregation of schools forces students to exercise choice. It is likely that the process is somewhat spurious in nature and could cause on upward bias for the estimates.

7. Results

7.1. Segregation of Schools in Capital City Area

7.1.1. Segregation by GPA

The segregation of schools by GPA increases in Helsinki and Espoo (figures 12 and 13) after the mid-1990s. Indeed, it does seem that segregation starts to increase in Helsinki and Espoo just after 1997. Students who graduated in 1997 started seventh grade in 1994, which was the first ‘official’ year of school choice in Helsinki (Seppänen, 2006). On the contrary, Vantaa, where school choice has been very limited, does not seem to experience any significant increase in segregation during the nine year period. This observation seems to support the idea and evidence from Sweden for example (see section 3.1) that school choice can increase segregation of schools. However, segregation of schools seems to follow to some extent the patterns of residential segregation by GPAs in Capital City Area (tables 25 and 26, Appendix 2b Residential Segregation.

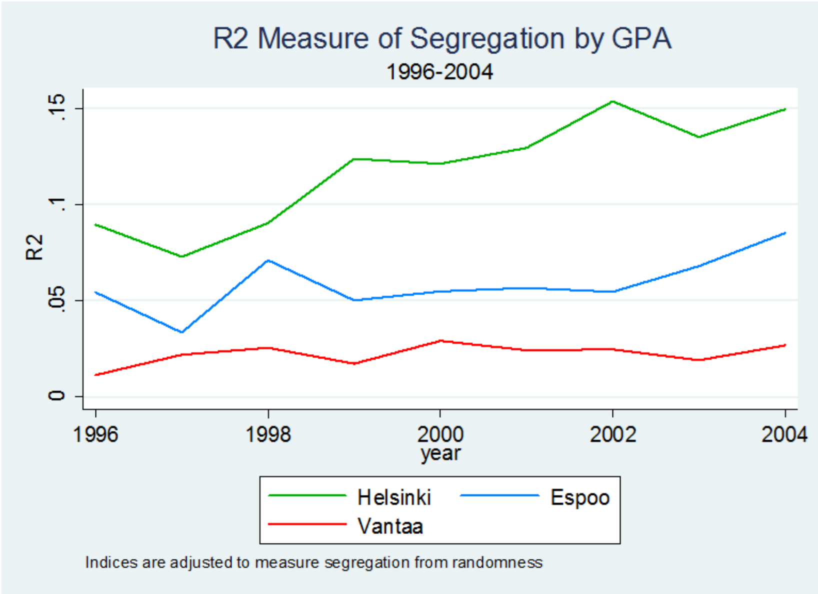

Figure 12 The development of the segregation by GPAs of ninth graders in Capital City area of Finland measured using variance that can be explained by the schools attended, R^2, between 1996 and 2004 measured using joint application data of all ninth graders between 1996 and 2004

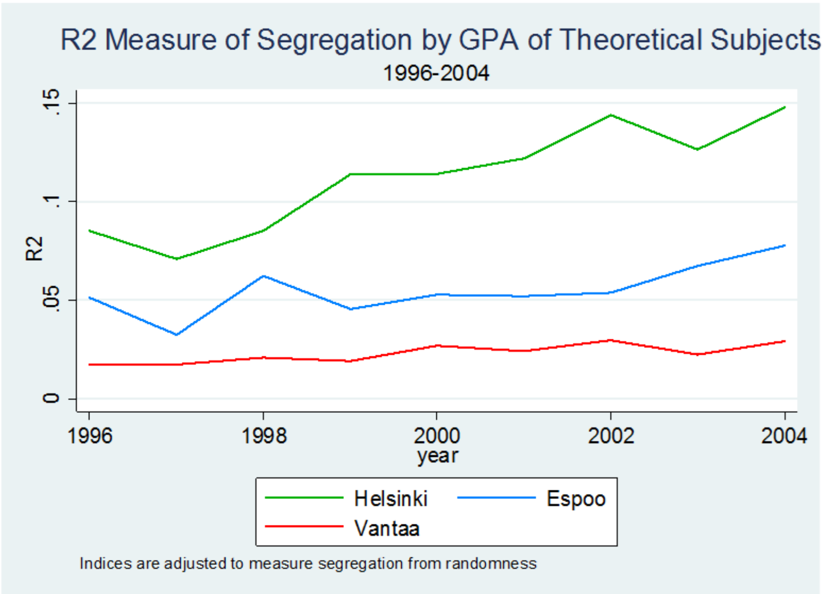

Figure 13 The development of the segregation by GPAs of theoretical subjects of ninth graders in Capital City area of Finland measured using variance that can be explained by the schools attended, R^2, between 1996 and 2004 measured using joint application data of all ninth graders between 1996 and 2004

However, patterns of pre-reform segregation are crucial as it seems that before 1997 segregation is decreasing in Helsinki and Espoo. For instance, the 1990s recession hit hard in Finland: high unemployment, drop in income inequality and spending cuts that hit comprehensive schooling (Pekkala, Intonen, & Järviö, 2005) could have influenced segregation. These factors are likely to some extent homogenize socio-economic background of students and peer groups in schools, creating the so-called ‘equality of poverty’ and hence could explain the decreasing segregation, as explained by Harris (2010). Therefore, data on before the reform and 1990s recession is crucial in determining whether segregation is actually affected by school choice or if it is now just resuming its original pre-recession growth path.

7.1.2. Segregation by High School Attendance and Graduates

Segregation measured by both, Duncan Index and variation that can be explained by the schools, show increasing segregation of schools by high school graduates in Helsinki after 1997. The measures for Vantaa and Espoo are steadier and only towards the end of the period it seems that segregation starts to increase in Espoo. According to Duncan index (figure 14) in 2004 almost 30% of the students of Helsinki should change their school to offset segregation from randomness. Variation that can be explained by the schools (figure 15), however, suggests a much more moderate segregation. The segregation measures are still significantly higher in Helsinki than in Vantaa, where segregation by high school graduation stays almost constant for the nine years. Also, residential segregation by high school graduation (in tables 29 and 30, Appendix 2b Residential Segregation) does not show any clear growth pattern between the years.

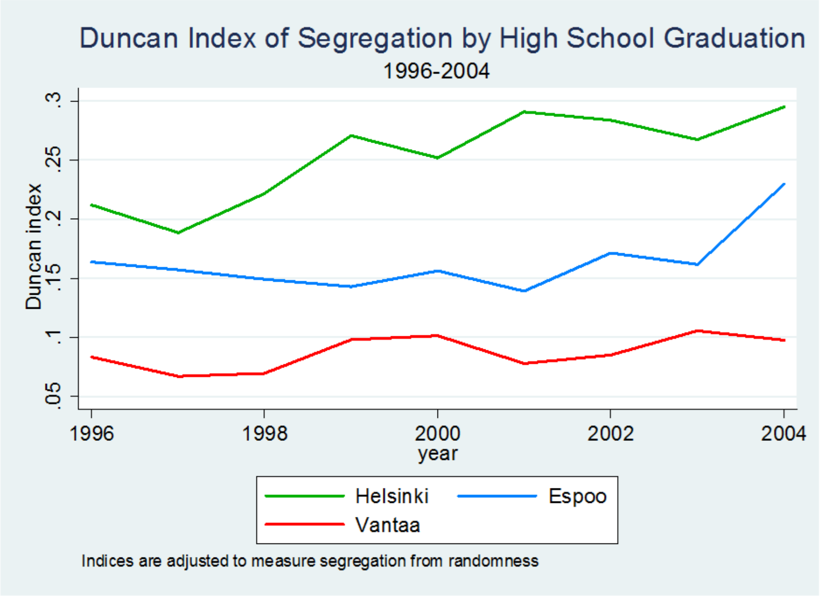

Figure 14 The development of the segregation by high school attendance of ninth graders in Capital City area of Finland measured using Duncan index between 1996 and 2004 measured using joint application data of all ninth graders between 1996 and 2004

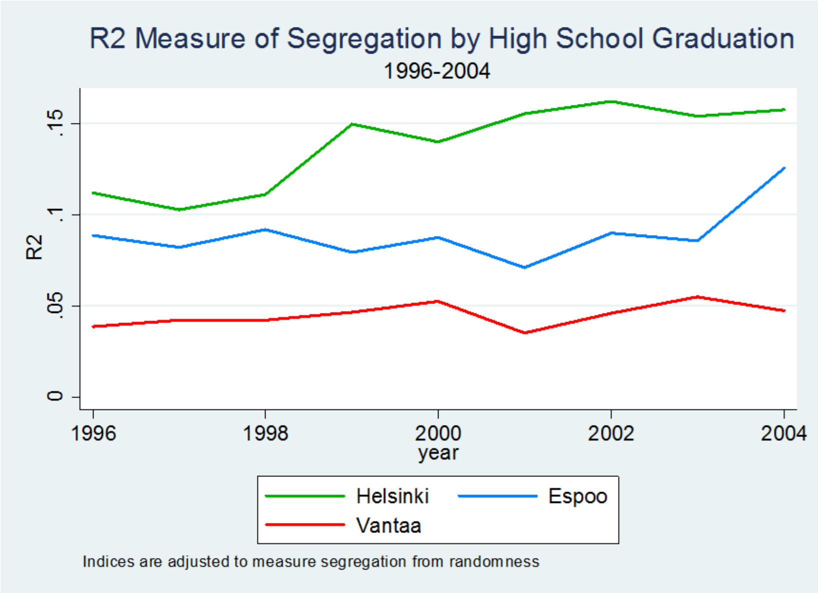

Figure 15 The development of the segregation by high school attendance of ninth graders in Capital City area of Finland measured using variance that can be explained by the schools attended, R^2, between 1996 and 2004 measured using joint application data of all ninth graders between 1996 and 2004

Segregation of schools by high school attendance seems to be increasing in Helsinki and Espoo towards the end of the period (figures 16 and 17) and similar patterns are observed for the residential segregation in tables 27 and 28 in Appendix 2b Residential Segregation. However, it is unclear whether the segregation was higher (or at the same level as in 2004) even before the nine year period in Helsinki, especially when measured with variation that can be explained by the schools (figure 17). Again, the pre-reform segregation measures are central in determining the effects of the reform. Also, segregation seems to increase in Vantaa at one point. Nevertheless, segregation by high school attendance seems to be more moderate than segregation by high school graduation.

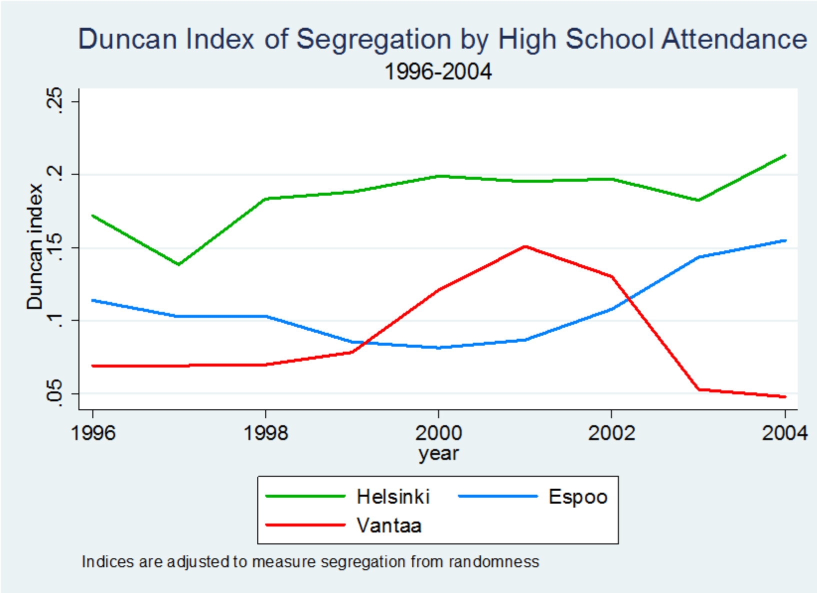

Figure 16 The development of the segregation by high school graduation of ninth graders of 1996 to 2004 in Capital City area of Finland measured using Duncan index measured using joint application data of all ninth graders between 1996 and 2004

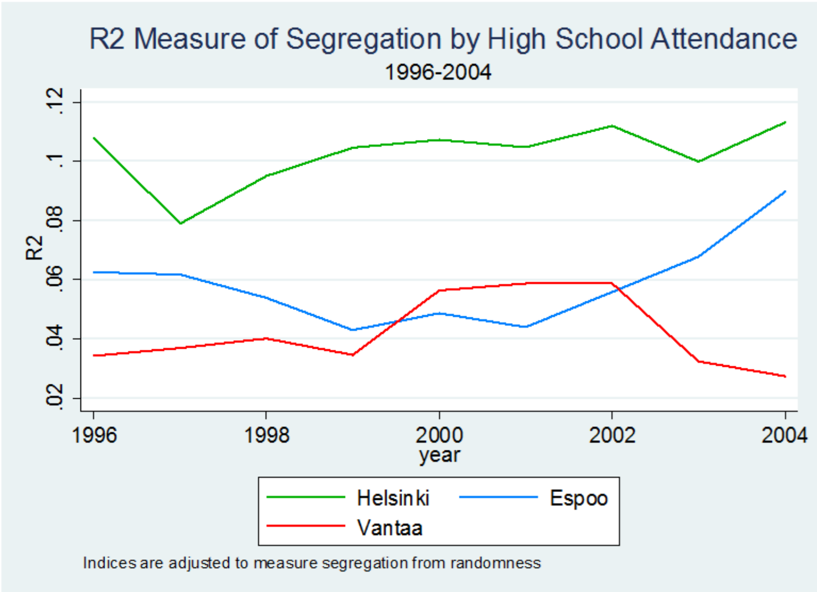

Figure 17 The development of the segregation by high school graduation of ninth graders of 1996 to 2004 in Capital City area of Finland measured using variance that can be explained by the schools attended, R^2, between 1996 and 2004 measured using joint application data of all ninth graders between 1996 and 2004

7.1.3. Segregation by Foreign Language

Segregation of schools by foreign language students measured by Duncan index (figure 18) shows very substantial segregation but it is inconclusive whether it actually increases during the period. In addition, segregation seems to fluctuate from year to year, which is a pattern that is not present in the previous segregation measures. Only Espoo seems to experience increasing segregation by foreign language after 1999. At the end of the period, over 40% of students should change their school to offset the segregation from randomness in Espoo.

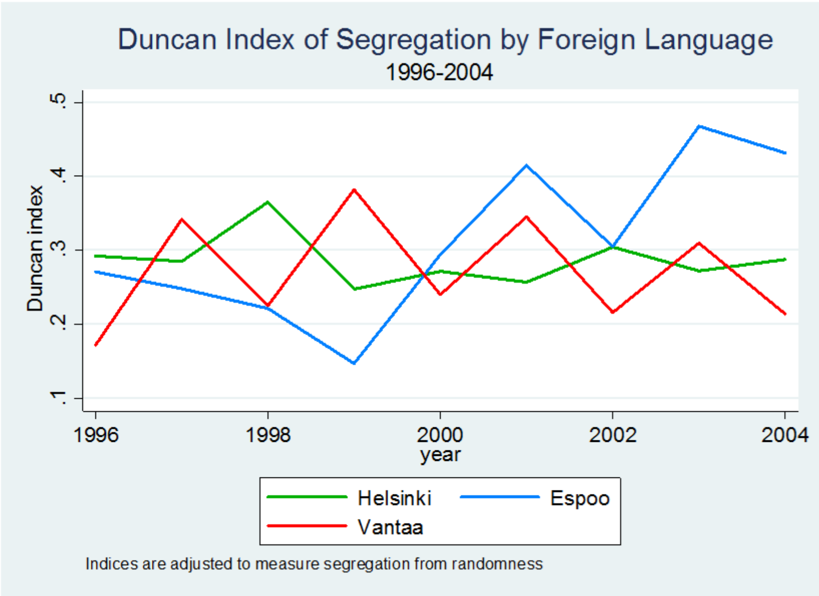

Figure 18 The development of the segregation by foreign speaking students in Capital City area of Finland measured using Duncan index between 1996 and 2004

However, measuring segregation with variation that can be explained by the schools shows a much more moderate segregation that seems to increase in all of the cities of the capital city area (figure 19). Segregation measured with isolation index does not capture any significant segregation of schools by foreign language in Helsinki and for the other two; the measures are very moderate and again show an increasing segregation towards the end of the period in Espoo (figure 20). On contrast to the other measures of segregation, there does not seem to be much difference between the cities in the segregation by foreign language students.

Even though the three measures are very different in terms of magnitude they all capture the increasing segregation in Espoo. The increase apparently starts in 1999 or 2000, which means that students who graduated at that point started seventh grade in 1996 or 1997. It may be the case that school choice started more properly in Espoo during those years, which could be one explanation for the increasing segregation. Similar patterns for Espoo can be observed in figures 16 and 17, as well, as segregation by high school attendance increases after the year 2000.

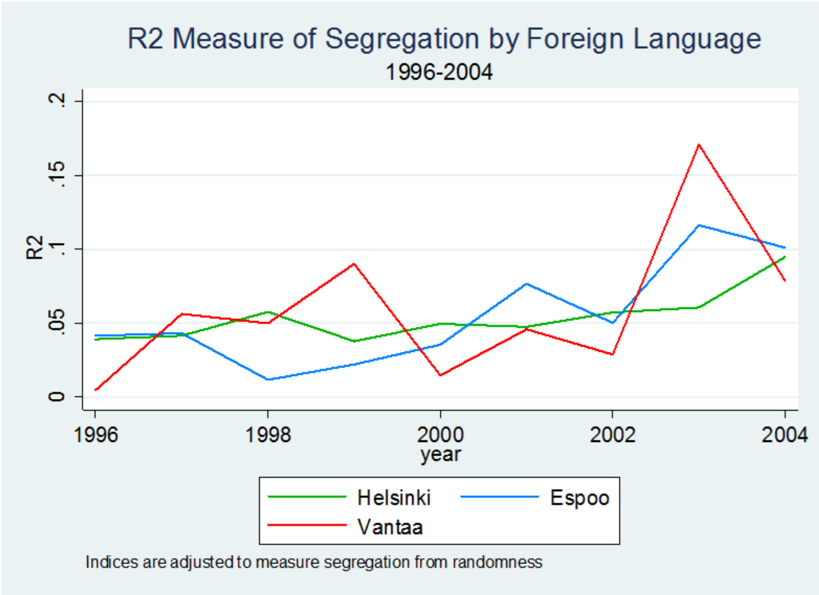

Figure 19 The development of the segregation by foreign speaking students in Capital City area of Finland measured using variance that can be explained by the schools attended, R^2, between 1996 and 2004 measured using joint application data of all ninth graders between 1996 and 2004

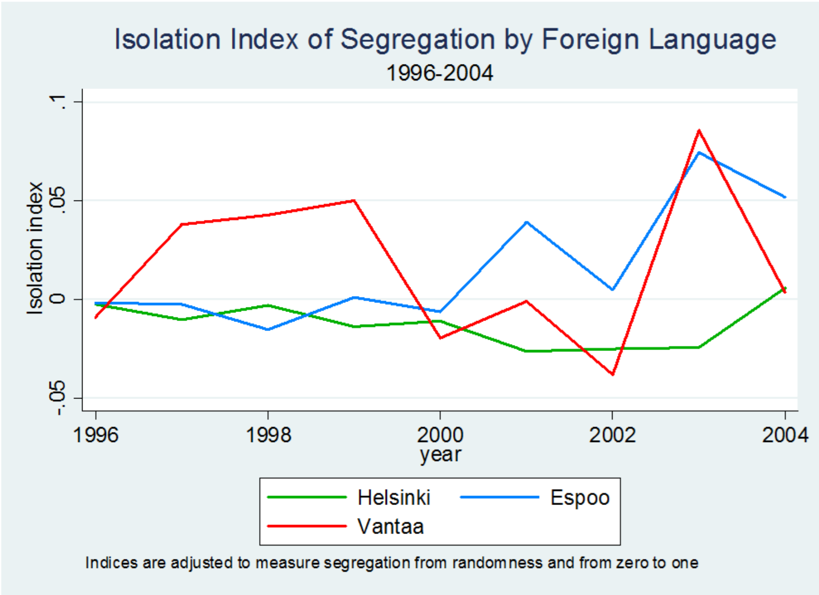

Figure 20 The development of the segregation by foreign speaking students in Capital City area of Finland measured using Isolation index between 1996 and 2004 measured using joint application data of all ninth graders between 1996 and 2004

Studies form Sweden and other countries specifically report increasing segregation by immigrant status after school choice reform (see for example Böhlmark and Lindahl (2007) and Söderström and Uusitalo (2010)). In the Finnish case, however, the foreign language that can be used to proxy immigrant status, has indeed one of the highest magnitudes of the segregation measures when measured by Duncan index, but the difference between the cities is negligible and there is no clear growth pattern after the reform. If increased school choice increases segregation by foreign language, I would expect Vantaa that has taken a much more stringent stand in school choice, to have significantly lower segregation than Helsinki. Also, I would expect Helsinki to experience growth in segregation by foreign language after the reform, but depending on the measure used, segregation fluctuates from year to year, slightly increases towards the end or is negligible. These results are somewhat unexpected, especially since the share of foreign speaking students increases dramatically during the nine years in capital city area. However, one explanation could be that foreign language variable is just too crude measure to capture any systematic sorting between native and immigrant students. The measures for residential segregation by foreign students are somewhat inconclusive as well (see tables 31 to 33 in Appendix 2b Residential Segregation).

Tables 12 to 23 in Appendix 2a Segregation of Schools, show measures of segregation for 13 cities over the nine years. Similar figures and tables for residential segregation in the capital city area are also available in Appendix 2b Residential Segregation.

7.2. Regression Results

7.2.1. Regressions with Municipality Fixed Effects

The regression results on segregation of schools by GPAs with municipality fixed effects (table 1) show that residential segregation plays a key role in segregation of schools, as predicted by the theory (see section 2.3). The estimates for residential segregation are significantly different from zero at 1% level. Share of students attending local school[11] proxies school choice and, even though the results are small and insignificant, the greater the share of local students (i.e. the less there is choice) the smaller the segregation of schools by GPA. Segregation is measured for all municipalities, with at least two schools, using Duncan index due to time limitations. GPA is converted into binary variable that takes value one when GPA is above average (7.5) and zero when below average. Figures 23 and 24 in Appendix 2a Segregation of Schools show that the binary GPAs behave as the measures for the variation that can be explained by the schools in figures 12 and 13 (section 7.1.1) in Capital City Area.

[11] Explained in section 5.2: It is the share of students attending school on the same postal code area as they reside or the most common school of the region.

Table 1 The municipality fixed effects regression results on the municipal level segregation of schools by GPA and GPA of theoretical subjects measured with Duncan index using joint application data of ninth graders from 1996 to 2004

Duncan indices	GPA	GPA of Theoretical subjects
Share of students attending local school	-0.022	-0.006
	(0.019)	(0.018)
Residential segregation	0.268	0.269
	(0.039)**	(0.037)**
Constant	0.037	0.024
	(0.013)**	(0.012)*
R2	0.06	0.06
Number of Observations	1,072	1,074
Number of Municipalities	270	271

* p<0.05; ** p<0.01

Regression results on the segregation by high school graduation and attendance (in table 2) show similar results, but now the share of students attending local school is significant at 1% level as well. Segregation of schools decreases by 0.0053 points if there is 10% increase in the share of students attending local school. This is in line with evidence from Sweden and other countries that have reported increasing segregation of schools with increased choice (see section 3.1). Also, since the motivation behind increased choice has been schools offering weighted curricula that can select students based on aptitude tests, it is not surprising that there is some evidence on increased segregation by ability, but I would have expected it to be shown most clearly in the results for segregation by GPA.

Table 2 The municipality fixed effects regression results on the municipal level segregation of schools by high school graduation and attendance measured with Duncan index using joint application data of ninth graders from 1996 to 2004

Duncan indices	High school graduation	High school attendance
Share of students attending local school	-0.053	-0.053
	(0.018)**	(0.020)**
Residential segregation	0.173	0.166
	(0.042)**	(0.043)**
Constant	0.078	0.075
	(0.012)**	(0.013)**
R2	0.03	0.03
Number of Observations	1,072	1,072
Number of Municipalities	270	270

* p<0.05; ** p<0.01

Results for the segregation by foreign language are quite similar but only the coefficient for residential segregation is significant at 1% level (table 3).

Table 3 The municipality fixed effects regression results on the municipal level segregation of schools by foreign students measured with Duncan index using joint application data of ninth graders from 1996 to 2004

Segregation by foreign students	Duncan index
Share of students attending local school	-0.080
	(0.083)
Residential segregation	0.148
	(0.040)**
Constant	0.115
	(0.055)*
R2	0.02
Number of Observations	1,074
Number of Municipalities	271

* p<0.05; ** p<0.01

It may not be that surprising that the share of students attending local school is insignificant in table 3. Just from looking at the segregation by foreign students in Capital City Area (figure 18), fluctuations from year to year are high and there is no clear pattern of growth or any difference between Helsinki and Vantaa that have opposing approaches towards school choice. On the other hand, the patterns are much smoother for the segregation of schools by GPA (figures 23 and 24 in Appendix 2a Segregation of Schools), and segregation increases in Helsinki and Espoo and stays almost constant for Vantaa during the nine years. However, these observations from Capital City Area are not supported by the municipality fixed effects model.

7.2.2. Regressions with Municipality Fixed Effects and Time Dummies

The regression estimates for choice with time dummies are somewhat reduced but are otherwise similar to the estimates measured only with municipality fixed effects. For the results on the segregation by GPA, only the results on residential segregation are significant at 1% level (table 4). The estimates for the share of students attending local school are not significantly different from zero.

Table 4 The municipality fixed effects regression results with time dummies on the municipal level segregation of schools by GPA and GPA of theoretical subjects measured with Duncan index using joint application data of ninth graders from 1996 to 2004

Duncan indices	GPA	GPA of Theoretical subjects
Share of students attending local school	-0.020	-0.001
	(0.020)	(0.018)
Residential segregation	0.265	0.267
	(0.040)**	(0.037)**
1997	0.003	-0.007
	(0.006)	(0.005)
1998	-0.000	-0.003
	(0.006)	(0.005)
1999	0.007	0.008
	(0.006)	(0.005)
2000	-0.007	-0.008
	(0.006)	(0.006)
2001	0.006	0.002
	(0.006)	(0.006)
2002	0.003	-0.003
	(0.006)	(0.006)
2003	0.001	-0.001
	(0.006)	(0.006)
2004	0.006	0.005
	(0.006)	(0.006)
Constant	0.034	0.021
	(0.014)*	(0.013)
R2	0.07	0.08
Number of Observations	1,072	1,074
Number of Municipalities	270	271

* p<0.05; ** p<0.01

There results for the segregation by high school graduation and attendance are quite similar to the results in table 2. The estimates for the share of students attending their local school are smaller, but still significant at 5% level. Now, 10% increase in the share of local students in schools decreases segregation of schools by high school graduation by 0.0041 points and segregation by high school attendance by 0.0049 points.

Table 5 The municipality fixed effects regression results with time dummies on the municipal level segregation of schools by high school graduation and attendance measured with Duncan index using joint application data of ninth graders from 1996 to 2004

Duncan indices	High school graduation	High school attendance
Share of students attending local school	-0.041	-0.049
	(0.018)*	(0.020)*
Residential segregation	0.170	0.166
	(0.042)**	(0.043)**
1997	0.001	0.005
	(0.005)	(0.006)
1998	0.003	0.002
	(0.005)	(0.006)
1999	0.011	0.002
	(0.006)	(0.006)
2000	0.001	-0.004
	(0.006)	(0.006)
2001	0.011	0.015
	(0.006)	(0.006)*
2002	0.011	0.003
	(0.006)	(0.006)
2003	0.015	0.007
	(0.006)*	(0.006)
2004	0.018	0.006
	(0.006)**	(0.006)
Constant	0.063	0.069
	(0.013)**	(0.014)**
R2	0.05	0.04
Number of Observations	1,072	1,072
Number of Municipalities	270	270

* $p<0.05$; ** $p<0.01$

The regressions for segregation by foreign students with time dummies (table 6) do not considerably alter the results. Estimate for residential segregation is significant at 1% level but again the estimate for the share of students attending local school is insignificant.

Table 6 The municipality fixed effects regression results with time dummies on the municipal level segregation of schools by foreign students measured with Duncan index using joint application data of ninth graders from 1996 to 2004

Segregation by foreign students	Duncan index
Share of students attending local school	-0.071
	(0.084)
Residential segregation	0.149
	(0.040)**
1997	0.010
	(0.025)
1998	0.015
	(0.025)
1999	0.040
	(0.025)
2000	0.023
	(0.026)
2001	0.047
	(0.025)
2002	0.024
	(0.026)
2003	-0.014
	(0.026)
2004	0.049
	(0.026)
Constant	0.088
	(0.060)
R2	0.03
Number of Observations	1,074
Number of Municipalities	271

* p<0.05; ** p<0.01

The model is likely to suffer from endogeneity, since segregation of schools might affect the choice between schools and not only the other way around. In other words, there is likely to be reverse causality that could cause an upward bias in the estimates for the share of students attending local school. The results from the municipality fixed effect models are inconclusive and probably inadequate to determine whether increased choice has impacted segregation of schools. To make any causal interpretation, more data on before the reform and a more sophisticated model is required.

8. Conclusions

School choice policies have mostly been introduced in countries with a comprehensive schooling system providing education to all children regardless of their financial status. Typically, these policies were introduced during the 1980s and 1990s as a part of government decentralization and the introduction of quasi-markets in public provision of goods and services, where the idea of the market economy or the theory of the firm was adopted to the public sector. Competition between schools is believed to improve quality and productivity of education. Advocates also believe that school choice can alleviate the pressures of residential segregation. However, increasing segregation of schools and 'cream skimming' in schools has raised concerns on the equality of education. In Finland, critics fear school choice will wreck the 'common to all' comprehensive schooling system.

School choice was introduced to Finnish comprehensive schooling system gradually through several small policy changes during the 1990s. The original motivation behind school choice in Finland was to inspire children and provide possibilities for differentiation. The driving force behind increased school choice in Finland has been schools offering weighted curricula from sports to sciences. At the time of the introduction, the idea that parents would choose a school based on quality was not even acknowledged. Recently, though, school choice has gained publicity in Finland and there have been talks about limiting choice to decrease segregation of schools (Liiten, 2012).

Theory and earlier research do support increasing segregation after introducing school choice. Key determinants for the development of segregation of schools are believed to be student selection methods, parental choice and the underlying residential segregation. Segregation of schools develops when parents with similar characteristic make similar choices, sorting students into schools with their peers. Also, student selection still gives priority to proximity[12] in Finland, unless a school teaches weighted curriculum, in which case aptitude tests are the main tool for student selection. Therefore, there is likely to be a strong link between residence and schools, and it is inconclusive whether introduction of school choice alleviates the pressure for 'selection by mortgage' in Finland. Furthermore, the implementation scheme of school choice is crucial in order

[12] Priority is given to the students living in the catchment area of the school, but the school is usually the nearest school.

for there to be any general improvements in the quality of education. In Finland, schools are capacity constraint and, in the case of oversubscription, cannot expand. In this type of setting, improvements in the quality of education are based on possible match quality between teachers and students and the quality of peers.

The original prediction was that segregation of schools is mostly determined by the underlying residential segregation but there could be some indication of sorting by ability due to increased amount of schools offering weighted curricula with aptitude tests. I used joint application data of ninth graders ending comprehensive school between 1996 and 2004. Segregation by ability increases in Helsinki, and is smaller and stays constant for Vantaa during the nine year period from 1996 to 2004. Helsinki and Vantaa have taken opposing strategies to the implementation of school choice: in Helsinki around half of the students exercise choice while in Vantaa the choice is very limited. However, segregation by foreign students does not show any clear pattern of growth during the years and the difference between Helsinki and Vantaa is negligible. Regression results from municipality fixed effects model do hint that increased choice has indeed increased segregation of schools by ability in Finland. However, the estimates are only significant in the case of segregation by high school attendance and graduation but not for segregation of schools by GPAs. Regression results do confirm the fact that the underlying residential segregation impacts the segregation of schools. The model suffers from endogeneity and results may be upward biased. These results are quite similar to results from Sweden, except for the segregation by foreign students (see Söderström and Uusitalo (2010) and Böhlmark and Lindahl (2007)).

There is evidence on increasing segregation of schools after the school choice reform in Finland. Whether segregation has increased due to increased choice between schools is left undetermined. More data on before the reform and a more sophisticated model are crucial in order to make any causal interpretation on the relationship between choice and segregation of schools. Even if choice between schools has increased segregation of schools, there might be a decreased pressure on residential segregation. The effects of the reform on residential segregation should be investigated before there are any policy changes that limit the possibility to exercise choice in Finland. Moreover, it is unclear whether segregation of schools will actually be reduced after restricting choice possibilities: restricted choice may lead to increased pressure for 'selection by mortgage' on top of the segregation of schools. Furthermore, restricted choice may have an impact on other factors as well, and for example, it could increase the pressure for segregation within schools as many of the schools already sort their students to classes according to their ability (Liiten, 2011). Other factors, such as potential effects on student outcomes and school productivity should also be considered before there are any policy changes. The purpose of this thesis has been to bring back the logic of economics, through which school choice was originally justified, to today's debates on the effects of school choice.

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Appendix 1 Descriptive Statistics

Table 7 Number of Intermediate Level Schools

	1996	1997	1998	1999	2000	2001	2002	2003	2004
Helsinki	67	68	70	72	71	69	74	67	66
Vantaa	23	22	23	25	23	24	25	22	24
Espoo	27	27	30	28	27	26	33	29	29
Turku	23	23	22	23	24	23	25	20	23
Tampere	23	20	19	21	21	23	23	22	21
Seinäjoki	6	6	3	5	5	6	6	6	4
Oulu	19	17	18	19	17	17	20	20	18
Jyväskylä	14	14	14	13	12	12	13	11	15
Imatra	6	6	5	7	5	5	6	4	4
Heinola	3	3	3	3	3	3	3	3	3
Nokia	3	3	3	3	3	4	3	3	3
Riihimäki	5	4	4	4	4	4	3	3	3
Naantali	2	2	2	3	3	4	2	2	2

Table 8 Number of Students in Ninth Grade

	1996	1997	1998	1999	2000	2001	2002	2003	2004
Helsinki	4613	4726	5050	4958	4812	4965	4604	4976	5304
Vantaa	1843	1846	1982	2067	1938	1939	1951	2016	2139
Espoo	2128	2188	2372	2311	2345	2260	2261	2334	2480
Turku	1648	1622	1708	1720	1614	1570	1579	1538	1742
Tampere	1762	1734	1827	1882	1762	1813	1767	1771	1818
Seinäjoki	395	383	357	383	368	386	349	349	366
Oulu	1138	1206	1187	1263	1225	1163	1184	1182	1218
Jyväskylä	899	814	837	826	837	754	787	755	817
Imatra	389	403	392	367	315	312	274	306	313
Heinola	253	283	261	254	297	257	267	226	227
Nokia	340	342	330	343	372	352	303	329	324
Riihimäki	281	312	311	323	331	298	322	321	299
Naantali	219	214	238	224	209	192	195	182	228

Table 9 Percentage Share of Foreign Speaking Students of Ninth Graders

	1996	1997	1998	1999	2000	2001	2002	2003	2004
Helsinki	4.1	5.0	5.1	5.3	6.0	7.1	8.0	7.2	8.5
Vantaa	1.4	1.9	2.6	4.2	3.4	4.7	5.6	6.8	7.5
Espoo	2.2	3.1	2.7	2.1	4.1	3.9	4.5	4.5	5.4

Turku	3.6	4.2	3.7	4.0	5.0	6.1	6.8	7.5	9.4
Tampere	1.5	2.2	1.9	1.9	3.2	2.9	3.7	4.6	4.2
Seinäjoki	0.5	1.0	0.6	0.8	0.3	1.8	0.3	0.9	1.4
Oulu	0.8	1.6	1.3	0.8	1.3	2.1	1.7	2.0	2.5
Jyväskylä	1.1	1.4	2.6	2.3	2.5	3.1	2.3	4.0	4.2
Imatra	1.3	0.7	0.8	0.8	1.0	1.9	0.7	1.3	1.6
Heinola	0.8	2.1	1.1	0.8	0.3	1.9	2.6	3.5	2.2
Nokia	0.6	0.9	0.6	1.7	0.5	.	0.3	0.9	1.5
Riihimäki	2.8	0.6	3.2	1.9	2.1	1.7	0.9	1.2	0.7
Naantali	.	0.5	0.4	0.9	1.4	.	0.5	.	.

Table 10 Share of High School Graduates of Ninth Graders

	1996	1997	1998	1999	2000	2001	2002	2003	2004
Helsinki	61.4	61.7	61.5	60.6	59.9	61.0	59.3	59.9	60.3
Vantaa	57.3	54.6	54.8	52.4	52.0	52.7	49.6	50.6	50.4
Espoo	68.2	66.8	65.0	66.0	66.1	65.2	67.1	66.5	64.1
Turku	55.6	58.8	54.6	55.4	59.1	55.2	55.1	56.0	53.8
Tampere	56.0	56.7	57.3	58.3	54.5	56.6	58.7	57.4	55.4
Seinäjoki	57.5	59.8	60.2	56.9	56.0	60.4	62.8	56.2	55.2
Oulu	56.8	60.1	57.8	56.6	55.9	56.1	57.8	56.3	57.4
Jyväskylä	52.6	56.8	54.0	53.4	57.7	55.8	56.4	59.1	54.1
Imatra	47.8	53.8	49.7	49.6	52.1	47.8	50.7	48.4	45.0
Heinola	51.8	49.1	52.9	50.0	48.5	46.3	47.9	47.3	47.6
Nokia	51.8	53.8	50.9	50.4	49.5	48.9	52.5	47.7	48.5
Riihimäki	52.3	56.1	47.9	50.8	42.6	49.3	46.9	50.8	49.8
Naantali	59.8	56.5	52.1	54.5	61.7	54.2	52.8	56.0	57.0

Table 11 High School Attendance of Ninth Graders

	1996	1997	1998	1999	2000	2001	2002	2003	2004
Helsinki	54.6	51.9	48.1	46.7	45.8	45.2	47.3	46.1	46.9
Vantaa	56.4	54.9	52.3	50.2	40.8	41.1	41.2	39.3	39.2
Espoo	61.7	62.2	60.3	55.2	59.4	55.4	60.1	58.2	55.9
Turku	48.4	47.9	42.9	43.5	46.3	43.9	44.7	45.9	43.6
Tampere	44.0	44.3	42.2	40.0	38.5	38.8	39.3	41.4	38.9
Seinäjoki	58.0	57.4	57.4	50.9	53.8	55.4	59.9	60.5	56.0
Oulu	54.7	51.0	49.1	50.6	49.2	51.8	51.8	53.9	52.4
Jyväskylä	49.4	50.5	47.8	49.4	53.6	48.7	48.7	51.0	45.3
Imatra	49.9	54.1	50.8	49.3	57.8	47.1	50.0	47.1	45.0
Heinola	56.9	49.8	54.0	48.8	49.5	47.9	47.6	46.5	48.0
Nokia	47.4	45.6	45.5	44.6	39.8	40.3	45.2	43.2	41.0
Riihimäki	38.8	46.5	48.6	45.8	40.2	49.0	45.3	47.4	47.5
Naantali	53.4	50.0	45.0	45.1	47.8	47.9	49.7	47.3	51.3

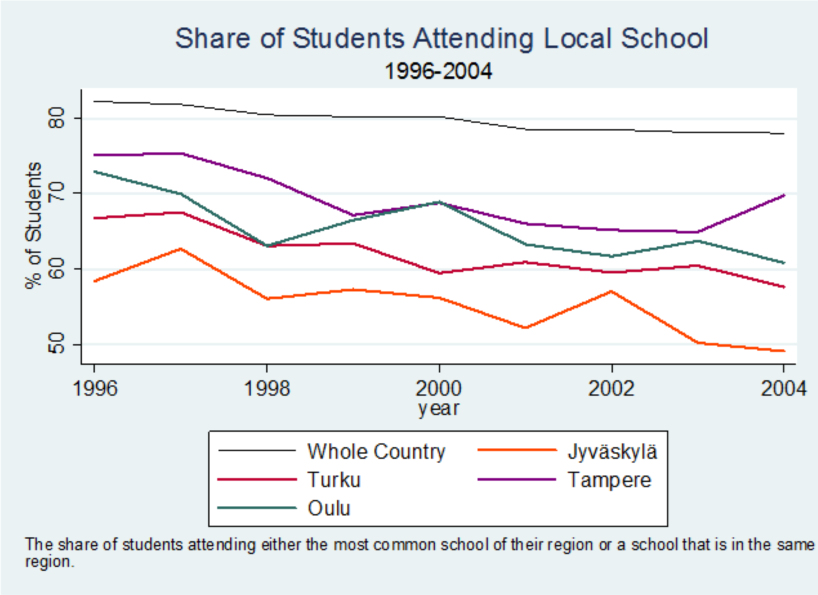

Figure 21 The development of the share of ninth graders attending their local school in Turku, Tampere, Jyväskylä and Oulu between 1996 and 2004 measured using joint application data of ninth graders between 1996 and 2004

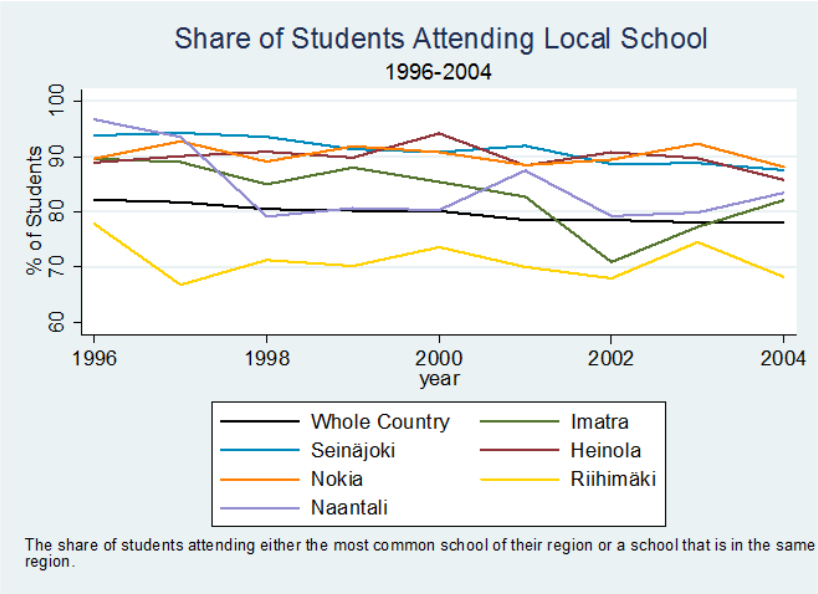

Figure 22 The development of the share of ninth graders attending their local school in Seinäjoki, Nokia, Naantali, Imatra, Heinola and Riihimäki between 1996 and 2004 measured using joint application data of ninth graders between 1996 and 2004

Appendix 2a Segregation of Schools

Table 12 Adjusted Duncan Index by High School Attendance

	1996	1997	1998	1999	2000	2001	2002	2003	2004
Helsinki	0.172	0.138	0.183	0.188	0.199	0.195	0.197	0.182	0.213

	(0.035)	(0.026)	(0.029)	(0.032)	(0.032)	(0.032)	(0.033)	(0.029)	(0.030)
Vantaa	0.069	0.069	0.070	0.079	0.121	0.151	0.130	0.053	0.048
	(0.024)	(0.025)	(0.031)	(0.034)	(0.038)	(0.035)	(0.040)	(0.033)	(0.028)
Espoo	0.114	0.103	0.103	0.086	0.081	0.087	0.108	0.143	0.155
	(0.032)	(0.037)	(0.029)	(0.031)	(0.040)	(0.031)	(0.034)	(0.029)	(0.041)
Turku	0.155	0.152	0.111	0.157	0.096	0.184	0.195	0.213	0.170
	(0.053)	(0.050)	(0.040)	(0.045)	(0.042)	(0.043)	(0.057)	(0.045)	(0.053)
Tampere	0.125	0.090	0.046	0.089	0.102	0.081	0.103	0.130	0.112
	(0.053)	(0.040)	(0.031)	(0.034)	(0.046)	(0.039)	(0.040)	(0.042)	(0.043)
Seinäjoki	0.041	-0.002	-0.005	-0.004	0.014	0.035	0.012	0.020	0.007
	(0.056)	(0.175)	(0.044)	(0.257)	(0.062)	(0.186)	(0.171)	(0.101)	(0.145)
Oulu	0.044	0.063	0.066	0.058	0.081	0.048	0.078	0.096	0.134
	(0.046)	(0.041)	(0.045)	(0.040)	(0.047)	(0.048)	(0.055)	(0.051)	(0.053)
Jyväskylä	0.149	0.095	0.070	0.164	0.089	0.140	0.118	0.038	0.088
	(0.079)	(0.074)	(0.079)	(0.061)	(0.063)	(0.055)	(0.051)	(0.046)	(0.057)
Imatra	0.108	0.105	0.089	0.056	0.083	0.159	0.165	0.172	0.061
	(0.107)	(0.088)	(0.065)	(0.097)	(0.089)	(0.087)	(0.108)	(0.081)	(0.053)
Heinola	0.034	0.030	0.005	0.017	-0.020	0.028	0.047	0.083	0.026
	(0.077)	(0.084)	(0.074)	(0.092)	(0.044)	(0.046)	(0.077)	(0.073)	(0.079)
Nokia	0.017	0.023	0.008	0.053	-0.009	0.005	0.018	-0.014	0.012
	(0.035)	(0.029)	(0.071)	(0.042)	(0.058)	(0.044)	(0.051)	(0.039)	(0.067)
Riihimäki	0.062	0.027	0.143	0.023	0.063	0.137	0.120	0.037	-0.049
	(0.064)	(0.031)	(0.082)	(0.036)	(0.045)	(0.076)	(0.067)	(0.046)	(0.009)
Naantali	0.016	0.024	-0.001	-0.009	0.035	0.122	0.042	0.067	0.142
	(0.015)	(0.019)	(0.026)	(0.018)	(0.036)	(0.070)	(0.051)	(0.067)	(0.098)

Table 13 Adjusted Duncan Index by High School Graduation

	1996	1997	1998	1999	2000	2001	2002	2003	2004
Helsinki	0.212	0.189	0.222	0.271	0.252	0.291	0.284	0.267	0.295
	(0.027)	(0.029)	(0.028)	(0.035)	(0.032)	(0.033)	(0.034)	(0.035)	(0.031)
Vantaa	0.083	0.067	0.070	0.098	0.101	0.078	0.085	0.106	0.098
	(0.027)	(0.032)	(0.031)	(0.031)	(0.033)	(0.025)	(0.029)	(0.034)	(0.029)
Espoo	0.164	0.157	0.149	0.143	0.156	0.139	0.171	0.162	0.230
	(0.040)	(0.040)	(0.048)	(0.044)	(0.045)	(0.041)	(0.042)	(0.038)	(0.047)
Turku	0.183	0.167	0.167	0.180	0.176	0.156	0.217	0.217	0.205
	(0.062)	(0.049)	(0.051)	(0.052)	(0.054)	(0.052)	(0.054)	(0.052)	(0.058)
Tampere	0.156	0.129	0.116	0.165	0.166	0.156	0.119	0.160	0.155
	(0.038)	(0.039)	(0.039)	(0.032)	(0.042)	(0.038)	(0.030)	(0.037)	(0.043)
Seinäjoki	0.071	0.003	-0.012	0.091	0.005	0.025	0.019	-0.005	0.015
	(0.211)	(0.205)	(0.049)	(0.276)	(0.153)	(0.187)	(0.159)	(0.117)	(0.135)
Oulu	0.049	0.058	0.071	0.087	0.099	0.101	0.113	0.141	0.165
	(0.045)	(0.043)	(0.058)	(0.049)	(0.056)	(0.043)	(0.052)	(0.051)	(0.058)
Jyväskylä	0.153	0.134	0.109	0.194	0.121	0.159	0.167	0.122	0.218
	(0.075)	(0.088)	(0.084)	(0.064)	(0.061)	(0.068)	(0.070)	(0.055)	(0.091)
Imatra	0.105	0.074	0.089	0.051	0.108	0.130	0.106	0.237	0.075
	(0.101)	(0.092)	(0.064)	(0.097)	(0.108)	(0.086)	(0.084)	(0.106)	(0.049)

Heinola	0.078	0.043	0.001	0.027	0.036	-0.023	0.056	0.063	0.032
	(0.069)	(0.081)	(0.074)	(0.092)	(0.042)	(0.052)	(0.077)	(0.073)	(0.078)
Nokia	0.075	-0.010	0.012	-0.013	0.016	-0.001	0.030	0.024	0.048
	(0.046)	(0.033)	(0.083)	(0.046)	(0.062)	(0.052)	(0.057)	(0.039)	(0.071)
Riihimäki	0.124	0.029	0.195	0.007	0.063	0.074	0.068	0.009	-0.014
	(0.078)	(0.035)	(0.106)	(0.038)	(0.050)	(0.048)	(0.057)	(0.033)	(0.024)
Naantali	0.022	0.028	0.066	0.011	-0.028	0.049	0.031	0.022	0.147
	(0.017)	(0.022)	(0.059)	(0.026)	(0.041)	(0.044)	(0.045)	(0.044)	(0.101)

Table 14 Adjusted R^2 by High School Attendance

	1996	1997	1998	1999	2000	2001	2002	2003	2004
Helsinki	0.108	0.079	0.095	0.105	0.107	0.105	0.112	0.100	0.113
	(0.025)	(0.016)	(0.019)	(0.019)	(0.019)	(0.020)	(0.021)	(0.019)	(0.020)
Vantaa	0.034	0.037	0.040	0.035	0.056	0.059	0.059	0.032	0.027
	(0.016)	(0.017)	(0.018)	(0.014)	(0.020)	(0.017)	(0.020)	(0.016)	(0.014)
Espoo	0.063	0.062	0.054	0.043	0.049	0.044	0.056	0.068	0.090
	(0.022)	(0.024)	(0.020)	(0.018)	(0.020)	(0.017)	(0.019)	(0.020)	(0.030)
Turku	0.094	0.089	0.055	0.082	0.059	0.084	0.113	0.102	0.088
	(0.037)	(0.031)	(0.021)	(0.027)	(0.025)	(0.027)	(0.037)	(0.028)	(0.032)
Tampere	0.079	0.051	0.037	0.040	0.049	0.041	0.058	0.063	0.050
	(0.035)	(0.025)	(0.020)	(0.016)	(0.022)	(0.021)	(0.026)	(0.021)	(0.018)
Seinäjoki	0.034	0.004	0.014	0.012	0.030	0.016	0.019	0.016	0.022
	(0.035)	(0.086)	(0.027)	(0.254)	(0.034)	(0.116)	(0.084)	(0.070)	(0.064)
Oulu	0.037	0.049	0.038	0.044	0.060	0.043	0.054	0.069	0.085
	(0.030)	(0.026)	(0.029)	(0.027)	(0.033)	(0.031)	(0.033)	(0.035)	(0.038)
Jyväskylä	0.080	0.068	0.048	0.076	0.037	0.057	0.045	0.010	0.043
	(0.053)	(0.048)	(0.039)	(0.037)	(0.032)	(0.025)	(0.025)	(0.011)	(0.026)
Imatra	0.082	0.062	0.047	0.032	0.056	0.056	0.091	0.065	0.019
	(0.063)	(0.057)	(0.040)	(0.067)	(0.054)	(0.032)	(0.059)	(0.034)	(0.014)
Heinola	0.034	0.033	0.026	0.033	0.010	0.014	0.030	0.035	0.029
	(0.049)	(0.044)	(0.043)	(0.049)	(0.023)	(0.024)	(0.042)	(0.037)	(0.042)
Nokia	0.010	0.008	0.021	0.016	0.011	0.009	0.016	0.008	0.018
	(0.018)	(0.013)	(0.034)	(0.019)	(0.023)	(0.019)	(0.025)	(0.018)	(0.030)
Riihimäki	0.018	0.004	0.048	0.010	0.016	0.040	0.037	0.008	-0.007
	(0.024)	(0.009)	(0.032)	(0.017)	(0.015)	(0.023)	(0.022)	(0.008)	(0.000)
Naantali	0.012	0.014	-0.002	-0.003	0.006	0.029	0.004	0.010	0.031
	(0.008)	(0.009)	(0.001)	(0.006)	(0.012)	(0.019)	(0.005)	(0.008)	(0.018)

Table 15 Adjusted R^2 by High School Graduation

	1996	1997	1998	1999	2000	2001	2002	2003	2004
Helsinki	0.112	0.103	0.111	0.150	0.140	0.155	0.162	0.154	0.158
	(0.019)	(0.019)	(0.019)	(0.024)	(0.023)	(0.023)	(0.025)	(0.026)	(0.022)
Vantaa	0.038	0.042	0.042	0.046	0.052	0.035	0.046	0.055	0.047
	(0.015)	(0.020)	(0.019)	(0.017)	(0.023)	(0.013)	(0.018)	(0.024)	(0.018)
Espoo	0.089	0.082	0.092	0.079	0.088	0.071	0.090	0.086	0.126

	(0.028)	(0.026)	(0.030)	(0.027)	(0.028)	(0.024)	(0.027)	(0.024)	(0.035)
Turku	0.125	0.108	0.096	0.117	0.110	0.097	0.127	0.130	0.125
	(0.049)	(0.042)	(0.038)	(0.038)	(0.038)	(0.040)	(0.041)	(0.040)	(0.045)
Tampere	0.076	0.067	0.055	0.074	0.076	0.072	0.051	0.073	0.071
	(0.027)	(0.030)	(0.020)	(0.024)	(0.027)	(0.026)	(0.021)	(0.022)	(0.023)
Seinäjoki	0.031	0.009	0.016	0.027	0.022	0.020	0.028	0.008	0.025
	(0.105)	(0.186)	(0.030)	(0.278)	(0.043)	(0.115)	(0.058)	(0.077)	(0.049)
Oulu	0.044	0.057	0.058	0.063	0.075	0.060	0.074	0.087	0.111
	(0.035)	(0.034)	(0.038)	(0.034)	(0.042)	(0.035)	(0.041)	(0.039)	(0.046)
Jyväskylä	0.085	0.094	0.067	0.096	0.048	0.075	0.064	0.035	0.113
	(0.053)	(0.059)	(0.046)	(0.042)	(0.034)	(0.039)	(0.028)	(0.017)	(0.060)
Imatra	0.067	0.057	0.044	0.031	0.055	0.046	0.062	0.114	0.016
	(0.054)	(0.058)	(0.038)	(0.067)	(0.086)	(0.029)	(0.047)	(0.058)	(0.011)
Heinola	0.034	0.033	0.023	0.036	0.015	0.009	0.032	0.032	0.029
	(0.041)	(0.043)	(0.040)	(0.051)	(0.022)	(0.024)	(0.042)	(0.039)	(0.042)
Nokia	0.021	0.009	0.027	0.013	0.021	0.015	0.023	0.014	0.028
	(0.020)	(0.020)	(0.042)	(0.024)	(0.034)	(0.027)	(0.033)	(0.021)	(0.039)
Riihimäki	0.056	0.007	0.069	0.009	0.015	0.021	0.021	0.001	-0.004
	(0.044)	(0.013)	(0.037)	(0.021)	(0.017)	(0.018)	(0.021)	(0.004)	(0.001)
Naantali	0.016	0.020	0.009	0.001	0.009	0.014	0.002	0.001	0.032
	(0.010)	(0.011)	(0.007)	(0.008)	(0.025)	(0.021)	(0.004)	(0.003)	(0.018)

Table 16 Adjusted R^2 by GPA

	1996	**1997**	**1998**	**1999**	**2000**	**2001**	**2002**	**2003**	**2004**
Helsinki	0.090	0.073	0.090	0.124	0.121	0.129	0.154	0.135	0.150
	(0.023)	(0.022)	(0.020)	(0.025)	(0.029)	(0.026)	(0.029)	(0.028)	(0.026)
Vantaa	0.011	0.022	0.025	0.017	0.029	0.024	0.025	0.019	0.027
	(0.006)	(0.010)	(0.008)	(0.008)	(0.014)	(0.014)	(0.011)	(0.011)	(0.016)
Espoo	0.054	0.033	0.071	0.050	0.055	0.057	0.055	0.068	0.085
	(0.019)	(0.012)	(0.022)	(0.019)	(0.018)	(0.019)	(0.018)	(0.017)	(0.022)
Turku	0.077	0.100	0.108	0.089	0.081	0.093	0.097	0.107	0.107
	(0.044)	(0.053)	(0.049)	(0.034)	(0.029)	(0.033)	(0.029)	(0.032)	(0.031)
Tampere	0.050	0.033	0.041	0.059	0.080	0.066	0.061	0.073	0.073
	(0.019)	(0.012)	(0.015)	(0.014)	(0.027)	(0.019)	(0.018)	(0.023)	(0.022)
Seinäjoki	0.029	-0.007	-0.004	-0.005	-0.002	-0.008	-0.009	0.010	-0.004
	(0.022)	(0.192)	(0.002)	(0.245)	(0.014)	(0.088)	(0.004)	(0.077)	(0.003)
Oulu	0.020	0.037	0.028	0.046	0.055	0.046	0.041	0.042	0.102
	(0.018)	(0.021)	(0.019)	(0.018)	(0.031)	(0.029)	(0.027)	(0.033)	(0.042)
Jyväskylä	0.078	0.088	0.078	0.115	0.050	0.092	0.096	0.059	0.105
	(0.054)	(0.055)	(0.066)	(0.049)	(0.033)	(0.038)	(0.040)	(0.024)	(0.050)
Imatra	0.037	0.055	0.057	0.039	0.003	0.052	0.068	0.113	0.016
	(0.052)	(0.031)	(0.031)	(0.045)	(0.078)	(0.030)	(0.061)	(0.043)	(0.012)
Heinola	0.004	-0.005	-0.003	0.031	-0.003	-0.008	-0.008	-0.009	-0.001
	(0.006)	(0.075)	(0.006)	(0.027)	(0.004)	(0.000)	(0.000)	(0.001)	(0.003)
Nokia	-0.004	-0.005	-0.003	0.008	-0.006	-0.008	-0.002	-0.005	0.001

	(0.001)	(0.000)	(0.002)	(0.005)	(0.000)	(0.016)	(0.006)	(0.001)	(0.008)
Riihimäki	0.005	0.481	0.036	0.000	-0.006	0.002	0.014	-0.003	0.004
	(0.028)	(0.316)	(0.020)	(0.006)	(0.002)	(0.005)	(0.010)	(0.001)	(0.005)
Naantali	0.013	-0.004	-0.002	0.007	-0.006	0.036	0.019	-0.004	0.035
	(0.009)	(0.000)	(0.001)	(0.008)	(0.138)	(0.023)	(0.012)	(0.001)	(0.020)

Table 17 Adjusted R^2 by GPA of Theoretical Subjects

	1996	1997	1998	1999	2000	2001	2002	2003	2004
Helsinki	0.085	0.071	0.085	0.114	0.114	0.122	0.144	0.126	0.148
	(0.023)	(0.021)	(0.018)	(0.024)	(0.027)	(0.025)	(0.027)	(0.026)	(0.026)
Vantaa	0.017	0.017	0.021	0.019	0.027	0.024	0.030	0.022	0.029
	(0.007)	(0.009)	(0.007)	(0.008)	(0.013)	(0.014)	(0.014)	(0.011)	(0.014)
Espoo	0.051	0.032	0.062	0.045	0.053	0.052	0.054	0.067	0.078
	(0.016)	(0.011)	(0.019)	(0.017)	(0.017)	(0.016)	(0.018)	(0.017)	(0.020)
Turku	0.060	0.081	0.082	0.077	0.071	0.086	0.088	0.096	0.098
	(0.033)	(0.045)	(0.036)	(0.027)	(0.024)	(0.027)	(0.026)	(0.027)	(0.026)
Tampere	0.041	0.026	0.037	0.047	0.061	0.050	0.048	0.064	0.067
	(0.018)	(0.010)	(0.014)	(0.013)	(0.024)	(0.015)	(0.014)	(0.019)	(0.019)
Seinäjoki	0.018	-0.005	-0.005	-0.002	-0.002	-0.005	-0.010	0.004	-0.004
	(0.011)	(0.189)	(0.001)	(0.256)	(0.015)	(0.094)	(0.002)	(0.072)	(0.002)
Oulu	0.010	0.023	0.016	0.037	0.048	0.035	0.034	0.036	0.083
	(0.011)	(0.014)	(0.013)	(0.016)	(0.025)	(0.022)	(0.022)	(0.028)	(0.037)
Jyväskylä	0.065	0.076	0.078	0.096	0.045	0.086	0.087	0.061	0.083
	(0.051)	(0.053)	(0.067)	(0.045)	(0.030)	(0.037)	(0.038)	(0.023)	(0.044)
Imatra	0.027	0.037	0.042	0.030	0.002	0.044	0.059	0.097	0.005
	(0.039)	(0.021)	(0.025)	(0.043)	(0.079)	(0.028)	(0.051)	(0.039)	(0.007)
Heinola	0.001	-0.006	-0.004	0.013	-0.004	-0.002	-0.007	-0.008	-0.008
	(0.004)	(0.075)	(0.006)	(0.016)	(0.002)	(0.003)	(0.001)	(0.001)	(0.000)
Nokia	-0.001	-0.005	-0.002	-0.001	-0.004	-0.005	-0.002	-0.003	0.001
	(0.002)	(0.000)	(0.001)	(0.002)	(0.002)	(0.002)	(0.004)	(0.001)	(0.003)
Riihimäki	0.001	0.387	0.022	-0.006	-0.008	0.005	0.011	-0.003	0.001
	(0.045)	(0.269)	(0.013)	(0.004)	(0.001)	(0.007)	(0.009)	(0.001)	(0.004)
Naantali	0.003	-0.002	-0.002	0.007	-0.010	0.028	0.019	-0.005	0.026
	(0.004)	(0.001)	(0.001)	(0.007)	(0.144)	(0.019)	(0.012)	(0.000)	(0.016)

Table 18 Adjusted and Standardized Isolation Index by Foreign Language

	1996	1997	1998	1999	2000	2001	2002	2003	2004
Helsinki	-0.002	-0.010	-0.003	-0.014	-0.011	-0.026	-0.025	-0.024	0.006
	(0.013)	(0.013)	(0.012)	(0.012)	(0.015)	(0.016)	(0.013)	(0.024)	(0.037)
Vantaa	-0.009	0.038	0.043	0.050	-0.020	-0.001	-0.038	0.086	0.004
	(0.007)	(0.050)	(0.050)	(0.055)	(0.010)	(0.022)	(0.016)	(0.137)	(0.062)
Espoo	-0.002	-0.002	-0.015	0.001	-0.006	0.039	0.005	0.074	0.052
	(0.027)	(0.027)	(0.007)	(0.023)	(0.016)	(0.037)	(0.019)	(0.046)	(0.034)
Turku	0.024	0.010	-0.012	-0.034	-0.023	0.005	0.007	-0.047	0.027
	(0.048)	(0.035)	(0.019)	(0.008)	(0.025)	(0.039)	(0.044)	(0.031)	(0.061)

Tampere	-0.015	-0.006	-0.013	-0.006	0.015	0.002	-0.007	-0.006	-0.021
	(0.003)	(0.015)	(0.007)	(0.006)	(0.025)	(0.016)	(0.016)	(0.030)	(0.014)
Seinäjoki	-0.013	-0.030	-0.005	-0.022	-0.014	-0.012	-0.015	-0.021	-0.016
	(0.005)	(0.003)	(0.006)	(0.003)	(0.003)	(0.020)	(0.003)	(0.003)	(0.008)
Oulu	-0.005	0.009	0.005	-0.016	-0.001	0.036	-0.014	0.070	0.034
	(0.005)	(0.014)	(0.010)	(0.004)	(0.008)	(0.028)	(0.008)	(0.059)	(0.041)
Jyväskylä	-0.016	-0.013	-0.006	-0.027	-0.018	-0.027	-0.028	-0.017	0.040
	(0.009)	(0.013)	(0.021)	(0.010)	(0.010)	(0.010)	(0.107)	(0.028)	(0.069)
Imatra	-0.001	-0.021	0.017	-0.018	0.004	-0.015	-0.013	-0.015	-0.021
	(0.028)	(0.003)	(0.026)	(0.006)	(0.032)	(0.017)	(0.006)	(0.006)	(0.002)
Heinola	-0.006	-0.028	0.029	-0.015	-0.004	-0.002	-0.032	-0.036	0.001
	(0.008)	(0.008)	(0.050)	(0.002)	(0.004)	(0.021)	(0.007)	(0.020)	(0.026)
Nokia	0.086	-0.014	-0.006	-0.006	-0.006	.	-0.006	-0.015	-0.006
	(0.075)	(0.003)	(0.006)	(0.017)	(0.005)	.	(0.003)	(0.003)	(0.014)
Riihimäki	-0.019	0.001	-0.041	-0.024	0.004	-0.024	-0.011	-0.018	-0.009
	(0.024)	(0.010)	(0.005)	(0.007)	(0.042)	(0.004)	(0.006)	(0.002)	(0.003)
Naantali	.	-0.012	-0.006	-0.009	-0.029	.	-0.006	.	.
	.	(0.002)	(0.003)	(0.007)	(0.004)	.	(0.004)	.	.

Table 19 Adjusted R^2 by Foreign Language

	1996	1997	1998	1999	2000	2001	2002	2003
Helsinki	0.039	0.042	0.058	0.038	0.049	0.047	0.057	0.061
	(0.010)	(0.009)	(0.009)	(0.007)	(0.010)	(0.010)	(0.009)	(0.018)
Vantaa	0.005	0.056	0.050	0.090	0.015	0.046	0.029	0.171
	(0.006)	(0.049)	(0.048)	(0.049)	(0.005)	(0.016)	(0.012)	(0.116)
Espoo	0.042	0.043	0.012	0.022	0.035	0.077	0.050	0.116
	(0.026)	(0.023)	(0.006)	(0.018)	(0.010)	(0.027)	(0.012)	(0.035)
Turku	0.060	0.052	0.025	0.008	0.034	0.067	0.075	0.031
	(0.037)	(0.026)	(0.014)	(0.005)	(0.018)	(0.027)	(0.030)	(0.017)
Tampere	0.000	0.017	0.006	0.013	0.047	0.031	0.031	0.052
	(0.003)	(0.010)	(0.005)	(0.005)	(0.022)	(0.012)	(0.010)	(0.022)
Seinäjoki	-0.007	-0.020	0.001	-0.014	-0.011	0.006	-0.012	-0.012
	(0.003)	(0.000)	(0.003)	(0.000)	(0.001)	(0.011)	(0.002)	(0.000)
Oulu	0.003	0.025	0.018	-0.008	0.012	0.057	0.003	0.094
	(0.004)	(0.010)	(0.008)	(0.003)	(0.008)	(0.022)	(0.006)	(0.054)
Jyväskylä	-0.005	0.001	0.021	-0.003	0.007	0.004	0.051	0.024
	(0.005)	(0.007)	(0.012)	(0.008)	(0.009)	(0.009)	(0.105)	(0.014)
Imatra	0.012	-0.014	0.024	-0.009	0.018	0.005	-0.005	-0.002
	(0.028)	(0.002)	(0.024)	(0.004)	(0.029)	(0.009)	(0.005)	(0.005)
Heinola	0.002	-0.006	0.040	-0.007	0.000	0.018	-0.005	0.001
	(0.004)	(0.001)	(0.047)	(0.000)	(0.002)	(0.012)	(0.001)	(0.008)
Nokia	0.091	-0.005	0.000	0.011	-0.001	.	-0.003	-0.006
	(0.070)	(0.000)	(0.003)	(0.009)	(0.002)	.	(0.001)	(0.000)
Riihimäki	0.010	0.007	-0.008	-0.005	0.030	-0.007	-0.002	-0.006
	(0.011)	(0.004)	(0.001)	(0.002)	(0.043)	(0.001)	(0.004)	(0.000)
Naantali	.	-0.007	-0.002	0.000	-0.014	.	-0.001	.

	.	(0.000)	(0.001)	(0.003)	(0.000)	.	(0.002)	.

Table 20 Adjusted Duncan Index by Foreign Language

	1996	1997	1998	1999	2000	2001	2002	2003	2004
Helsinki	0.292	0.285	0.365	0.247	0.271	0.257	0.304	0.272	0.288
	(0.047)	(0.047)	(0.046)	(0.039)	(0.043)	(0.041)	(0.036)	(0.036)	(0.039)
Vantaa	0.171	0.342	0.225	0.382	0.240	0.345	0.216	0.310	0.213
	(0.108)	(0.100)	(0.084)	(0.094)	(0.062)	(0.103)	(0.056)	(0.094)	(0.058)
Espoo	0.271	0.248	0.221	0.147	0.294	0.415	0.305	0.468	0.432
	(0.103)	(0.075)	(0.092)	(0.095)	(0.066)	(0.090)	(0.070)	(0.087)	(0.075)
Turku	0.246	0.270	0.200	0.115	0.210	0.331	0.270	0.127	0.295
	(0.115)	(0.091)	(0.097)	(0.071)	(0.081)	(0.087)	(0.087)	(0.072)	(0.083)
Tampere	0.148	0.143	0.121	0.299	0.248	0.329	0.255	0.217	0.181
	(0.147)	(0.109)	(0.113)	(0.113)	(0.095)	(0.083)	(0.077)	(0.087)	(0.073)
Seinäjoki	0.334	-0.258	0.352	-0.145	-0.059	0.460	0.097	-0.216	0.128
	(0.373)	(0.025)	(0.349)	(0.089)	(0.531)	(0.355)	(0.611)	(0.066)	(0.153)
Oulu	0.373	0.360	0.432	-0.197	0.295	0.493	0.148	0.353	0.396
	(0.276)	(0.131)	(0.173)	(0.214)	(0.184)	(0.131)	(0.091)	(0.137)	(0.120)
Jyväskylä	0.063	0.248	0.313	-0.007	0.182	0.177	0.157	0.271	0.280
	(0.176)	(0.220)	(0.128)	(0.070)	(0.211)	(0.179)	(0.239)	(0.118)	(0.157)
Imatra	0.225	-0.326	0.569	0.146	0.114	0.189	0.176	-0.063	-0.117
	(0.346)	(0.375)	(0.542)	(0.480)	(0.424)	(0.246)	(0.602)	(0.267)	(0.253)
Heinola	0.367	-0.008	0.338	-0.346	0.093	0.469	-0.063	-0.076	0.491
	(0.380)	(0.081)	(0.414)	(0.065)	(0.570)	(0.351)	(0.061)	(0.093)	(0.359)
Nokia	0.273	-0.134	0.289	0.390	0.240	0.000	-0.057	-0.161	0.366
	(0.410)	(0.093)	(0.348)	(0.318)	(0.322)	(0.000)	(0.504)	(0.084)	(0.310)
Riihimäki	0.280	0.454	-0.113	-0.047	0.321	-0.097	0.073	-0.257	-0.176
	(0.216)	(0.544)	(0.046)	(0.105)	(0.342)	(0.108)	(0.299)	(0.054)	(0.383)
Naantali	0.000	-0.028	-0.192	0.199	-0.226	0.000	-0.122	0.000	0.000
	(0.000)	(0.010)	(0.346)	(0.306)	(0.038)	(0.000)	(0.420)	(0.000)	(0.000)

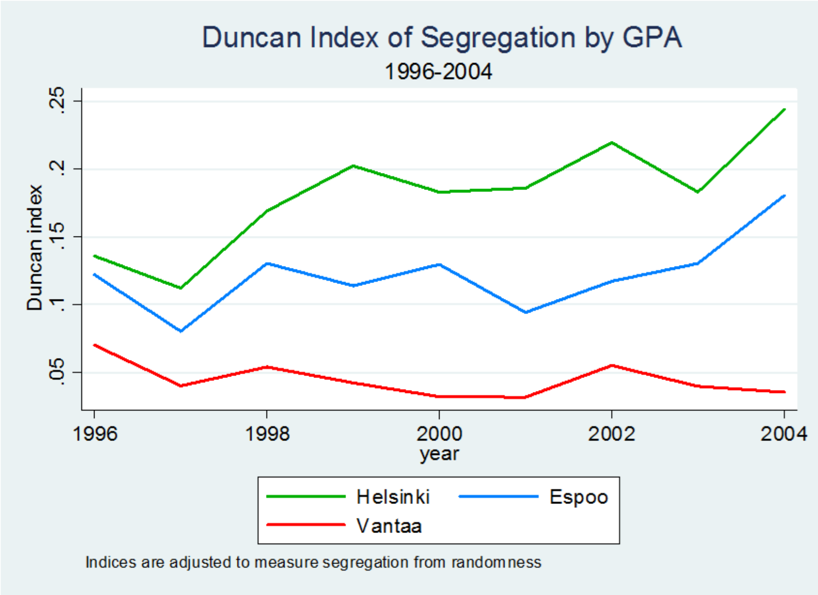

Figure 23 The development of the segregation by binary GPA (1 if GPA above 7.5) of ninth graders in Capital City area of Finland measured using Duncan index between 1996 and 2004 measured using joint application data of ninth graders between 1996 and 2004

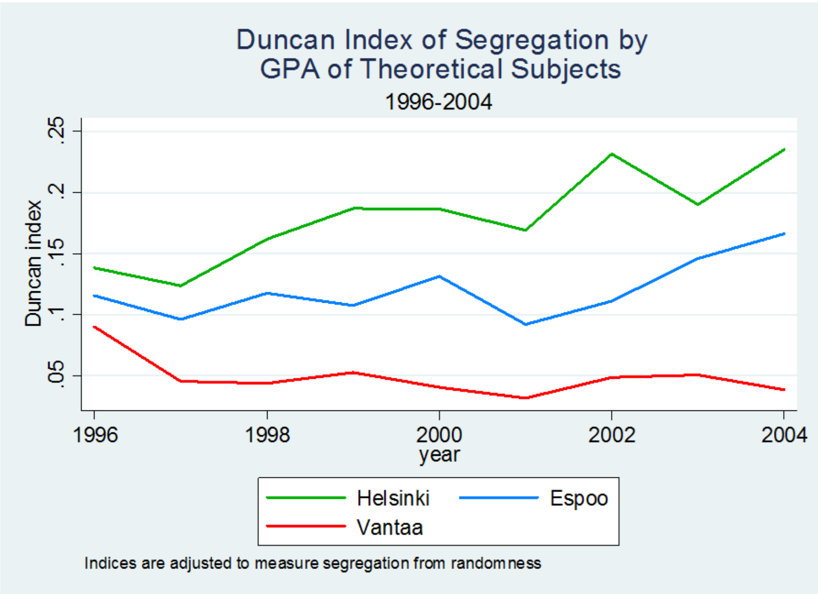

Figure 24 The development of the segregation by binary GPA of theoretical subjects (1 if GPA above 7.5) of ninth graders in Capital City area of Finland measured using Duncan index between 1996 and 2004 measured using joint application data of ninth graders between 1996 and 2004

Appendix 2b Residential Segregation

The magnitude of residential segregation in capital city area is very moderate compared to segregation of schools. However, they are not directly comparable, since residential segregation is measured using postal codes as entities which might be a little bit too big area to capture the actual residential segregation of neighborhoods. However, it should still illustrate the patterns in residential segregation.

Residential segregation by GPA increases in capital city area after 1997, even though it is not significant for Vantaa (figures 25 and 26). Similar to segregation of schools, residential segregation in Helsinki is the highest and in Vantaa it is the lowest. Sudden jumps after 1997 are hard to explain, and like in the case of segregation of schools, more data on before the reform is needed.

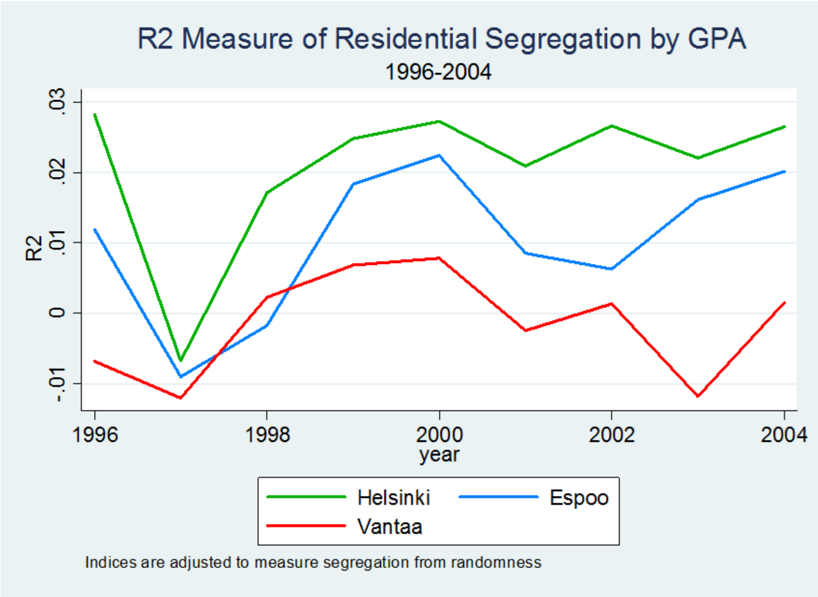

Figure 25 The development of the residential segregation by GPA of ninth graders in Capital City area of Finland measured using the variation that can be explained by the schools, R^2, between 1996 and 2004 measured using joint application data of ninth graders between 1996 and 2004

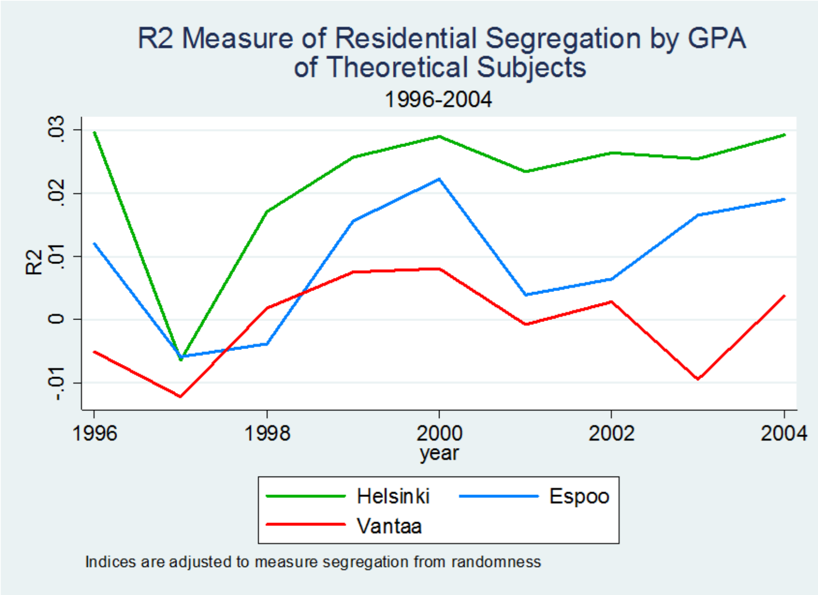

Figure 26 The development of the residential segregation by GPA of theoretical subjects of ninth graders in Capital City area of Finland measured using variation that can be explained by the schools, R^2, between 1996 and 2004 measured using joint application data of ninth graders between 1996 and 2004

Residential segregation by high school attendance shows small growth in Helsinki, but fluctuates more in Espoo and Vantaa (figures 27 and 28) and hence it is unclear whether there is any growth in segregation during the observation period. Again, Helsinki seems to have the highest residential segregation but the difference between the cities is no longer as substantial as it was when measured for schools.

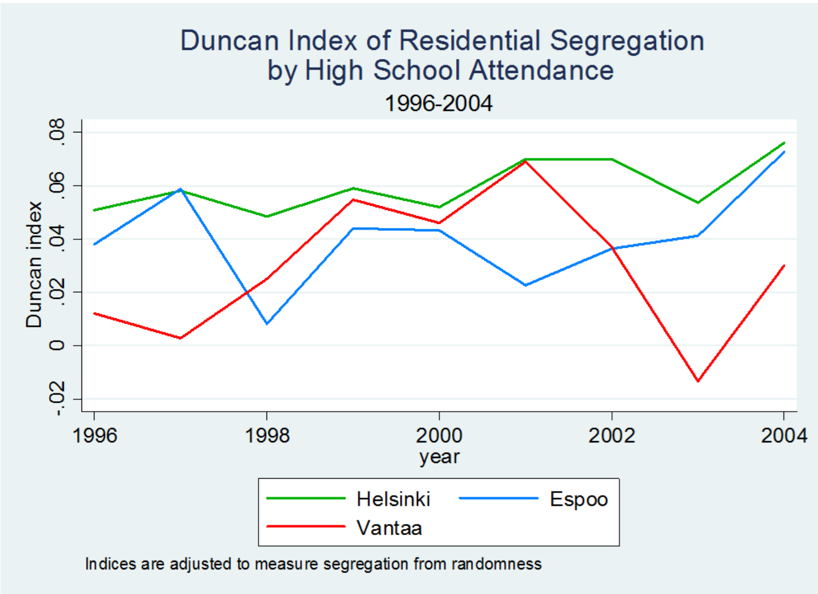

Figure 27 The development of the residential segregation by high school attendance of ninth graders in Capital City area of Finland measured using Duncan index between 1996 and 2004 measured using joint application data of ninth graders between 1996 and 2004

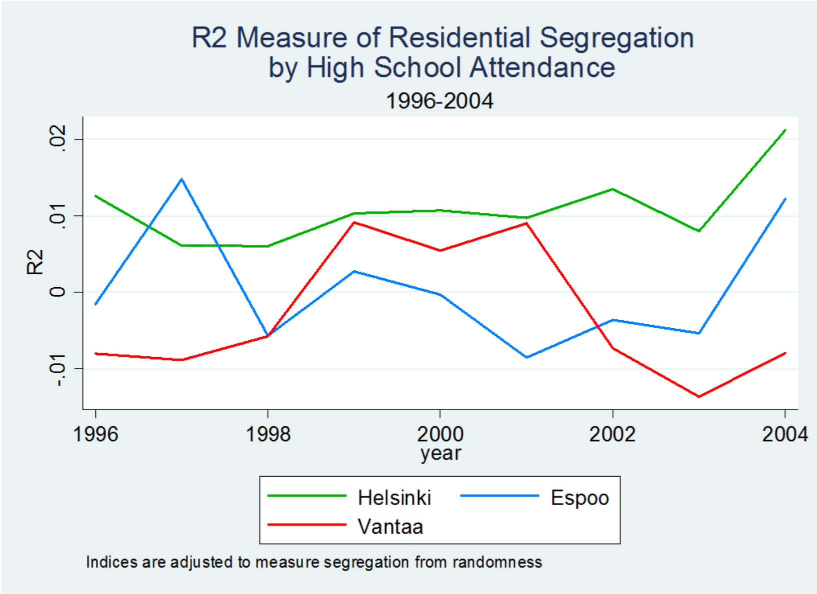

Figure 28 The development of the residential segregation by high school attendance of ninth graders in Capital City area of Finland measured using variation that can be explained by the schools, R^2, between 1996 and 2004 measured using joint application data of ninth graders between 1996 and 2004

Residential segregation for high school graduation is higher in Helsinki and Espoo than in Vantaa, but there is no clear pattern for growth during the period (figures 29 and 30)

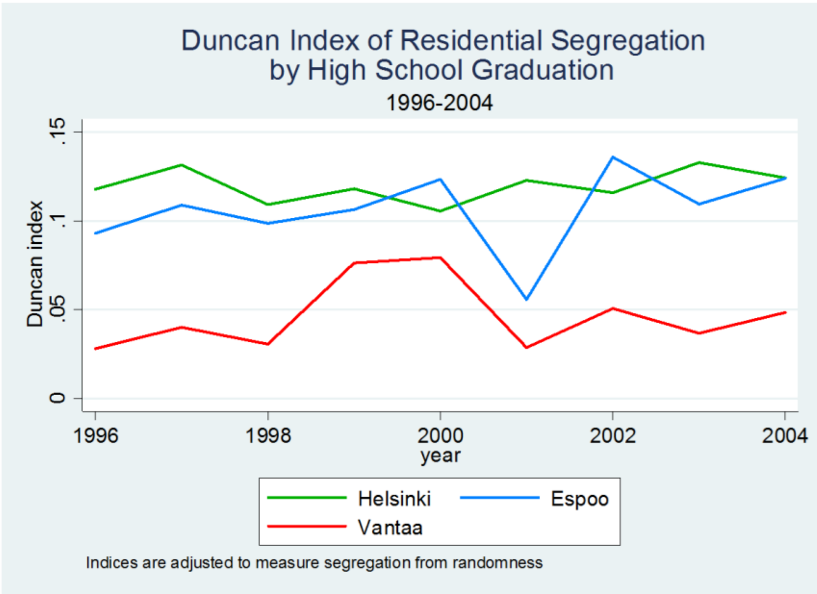

Figure 29 The development of the residential segregation by high school graduation of ninth graders in Capital City area of Finland measured using Duncan index between 1996 and 2004 measured using joint application data of ninth graders between 1996 and 2004

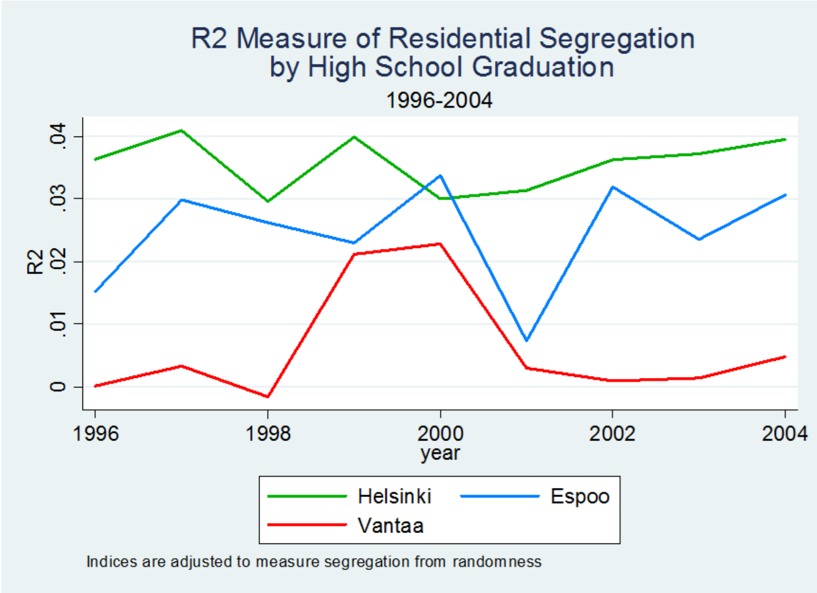

Figure 30 The development of the residential segregation by high school graduation of ninth graders in Capital City area of Finland measured using variation that can be explained by the schools, R^2, between 1996 and 2004 measured using joint application data of ninth graders between 1996 and 2004

Residential segregation by foreign language shows similar patterns as in segregation of schools. Segregation fluctuates from year to year but does seem to increase towards the end of the nine year period (figures 31 to 33).

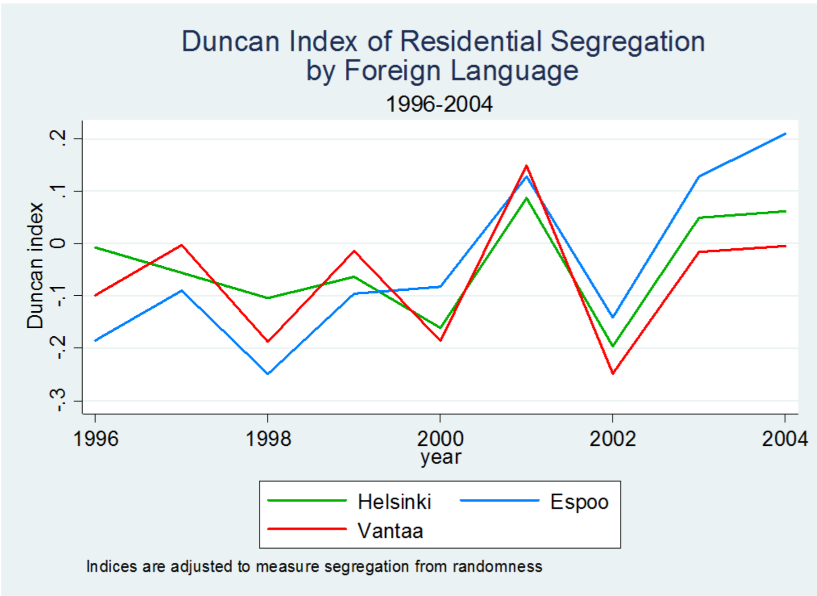

Figure 31 The development of the residential segregation by foreign speaking ninth graders in Capital City area of Finland measured using Duncan index between 1996 and 2004 measured using joint application data of ninth graders between 1996 and 2004

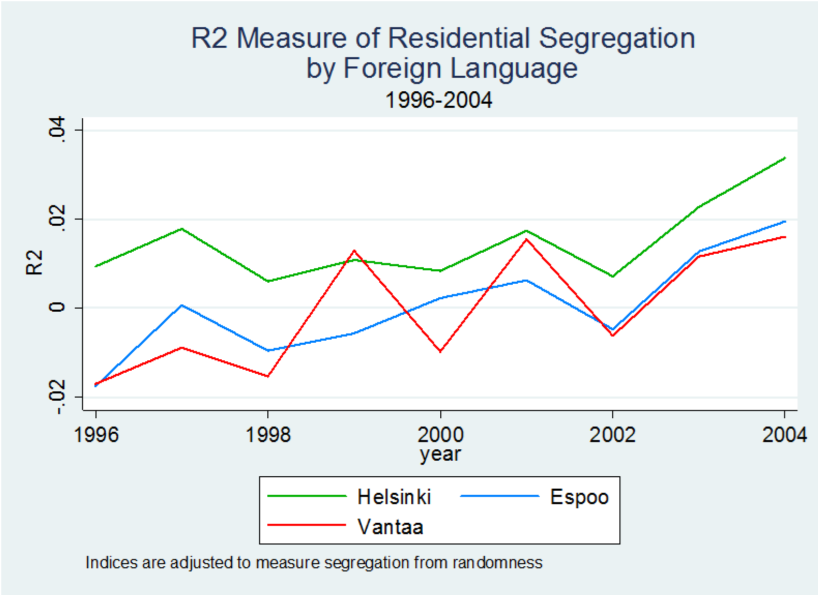

Figure 32 The development of the residential segregation by foreign speaking ninth graders in Capital City area of Finland measured using variation that can be explained by the schools, R^2, between 1996 and 2004 measured using joint application data of ninth graders between 1996 and 2004

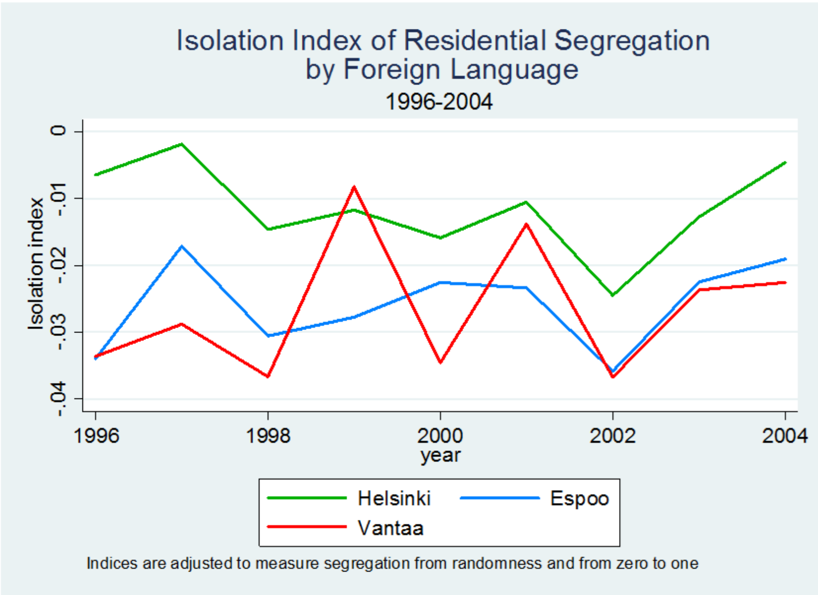

Figure 33 The development of the residential segregation by foreign speaking ninth graders in Capital City area of Finland measured using Isolation index between 1996 and 2004 measured using joint application data of ninth graders between 1996 and 2004

Table 21 Adjusted R^2 for Residential Segregation by High School Attendance

	1996	1997	1998	1999	2000	2001	2002	2003	2004
Helsinki	0.013	0.006	0.006	0.010	0.011	0.010	0.013	0.008	0.021
	(0.009)	(0.005)	(0.007)	(0.008)	(0.007)	(0.007)	(0.008)	(0.007)	(0.011)

Vantaa	-0.008	-0.009	-0.006	0.009	0.005	0.009	-0.007	-0.014	-0.008
	(0.006)	(0.007)	(0.008)	(0.011)	(0.013)	(0.010)	(0.006)	(0.008)	(0.007)
Espoo	-0.002	0.015	-0.006	0.003	0.000	-0.008	-0.004	-0.005	0.012
	(0.007)	(0.012)	(0.009)	(0.009)	(0.007)	(0.006)	(0.009)	(0.007)	(0.011)
Turku	0.026	0.016	-0.007	-0.004	-0.008	0.002	0.028	-0.013	0.007
	(0.015)	(0.017)	(0.008)	(0.008)	(0.010)	(0.013)	(0.019)	(0.008)	(0.011)
Tampere	-0.010	-0.008	-0.006	-0.007	-0.006	0.003	0.004	0.005	0.011
	(0.005)	(0.006)	(0.008)	(0.007)	(0.006)	(0.009)	(0.011)	(0.012)	(0.016)
Seinäjoki	0.002	-0.009	0.009	-0.013	-0.001	0.003	-0.030	-0.035	-0.011
	(0.016)	(0.013)	(0.018)	(0.010)	(0.013)	(0.020)	(0.004)	(0.002)	(0.011)
Oulu	-0.016	-0.008	-0.003	-0.017	-0.019	-0.014	-0.012	-0.010	-0.016
	(0.006)	(0.009)	(0.011)	(0.006)	(0.004)	(0.008)	(0.009)	(0.009)	(0.008)
Jyväskylä	0.025	0.006	-0.003	0.017	-0.001	0.005	0.017	-0.010	-0.002
	(0.017)	(0.016)	(0.012)	(0.015)	(0.012)	(0.014)	(0.023)	(0.010)	(0.015)
Imatra	-0.017	-0.015	0.013	0.010	0.027	-0.011	0.005	0.008	-0.001
	(0.011)	(0.008)	(0.014)	(0.013)	(0.023)	(0.010)	(0.018)	(0.020)	(0.016)
Heinola	0.032	-0.028	-0.008	-0.027	0.018	0.011	-0.018	-0.034	-0.002
	(0.027)	(0.004)	(0.024)	(0.003)	(0.024)	(0.027)	(0.018)	(0.003)	(0.018)
Nokia	-0.023	-0.012	-0.032	-0.002	-0.024	-0.024	-0.022	-0.031	-0.017
	(0.006)	(0.008)	(0.004)	(0.013)	(0.006)	(0.007)	(0.011)	(0.003)	(0.011)
Riihimäki	0.000	0.008	-0.005	-0.018	-0.023	-0.007	-0.008	-0.022	-0.032
	(0.012)	(0.026)	(0.011)	(0.012)	(0.008)	(0.025)	(0.013)	(0.016)	(0.004)
Naantali	-0.026	-0.033	-0.035	-0.018	-0.033	-0.005	-0.033	-0.028	-0.031
	(0.009)	(0.001)	(0.002)	(0.009)	(0.001)	(0.016)	(0.004)	(0.007)	(0.004)

Table 22 Adjusted R^2 for Residential Segregation by High School Graduates

	1996	1997	1998	1999	2000	2001	2002	2003	2004
Helsinki	0.036	0.041	0.030	0.040	0.030	0.031	0.036	0.037	0.040
	(0.011)	(0.011)	(0.009)	(0.011)	(0.010)	(0.009)	(0.011)	(0.010)	(0.013)
Vantaa	0.000	0.003	-0.002	0.021	0.023	0.003	0.001	0.001	0.005
	(0.010)	(0.009)	(0.009)	(0.014)	(0.012)	(0.011)	(0.008)	(0.012)	(0.011)
Espoo	0.015	0.030	0.026	0.023	0.034	0.007	0.032	0.024	0.031
	(0.009)	(0.013)	(0.014)	(0.011)	(0.013)	(0.009)	(0.015)	(0.012)	(0.013)
Turku	0.027	0.010	0.011	0.019	-0.001	0.021	0.030	-0.005	0.021
	(0.015)	(0.013)	(0.015)	(0.013)	(0.011)	(0.017)	(0.015)	(0.010)	(0.014)
Tampere	0.012	0.005	0.009	0.009	0.029	0.026	0.027	0.032	0.030
	(0.008)	(0.010)	(0.013)	(0.012)	(0.020)	(0.015)	(0.018)	(0.016)	(0.022)
Seinäjoki	0.010	-0.010	-0.011	-0.008	-0.006	0.017	-0.012	-0.033	-0.004
	(0.016)	(0.012)	(0.012)	(0.011)	(0.011)	(0.024)	(0.009)	(0.003)	(0.014)
Oulu	-0.010	0.002	0.017	0.000	-0.008	-0.009	-0.018	0.003	-0.013
	(0.006)	(0.010)	(0.015)	(0.010)	(0.006)	(0.008)	(0.007)	(0.012)	(0.006)
Jyväskylä	0.034	0.015	-0.002	0.019	0.001	0.012	0.042	-0.009	0.025
	(0.022)	(0.022)	(0.010)	(0.017)	(0.012)	(0.017)	(0.031)	(0.013)	(0.031)
Imatra	-0.010	-0.022	0.013	0.013	0.003	-0.011	-0.009	0.058	0.004
	(0.017)	(0.005)	(0.015)	(0.020)	(0.013)	(0.009)	(0.016)	(0.034)	(0.026)
Heinola	0.054	-0.019	-0.014	-0.009	0.000	0.046	-0.016	-0.016	-0.013
	(0.040)	(0.011)	(0.016)	(0.009)	(0.015)	(0.042)	(0.015)	(0.018)	(0.016)
Nokia	-0.027	0.003	-0.034	-0.022	-0.017	-0.003	-0.028	-0.033	-0.008
	(0.003)	(0.018)	(0.002)	(0.006)	(0.008)	(0.016)	(0.006)	(0.003)	(0.020)
Riihimäki	0.013	-0.032	-0.015	-0.031	-0.019	-0.009	-0.017	-0.024	-0.031
	(0.020)	(0.001)	(0.007)	(0.003)	(0.011)	(0.024)	(0.011)	(0.015)	(0.008)
Naantali	-0.023	-0.035	-0.024	-0.021	-0.031	-0.032	-0.040	-0.020	-0.040
	(0.005)	(0.000)	(0.007)	(0.007)	(0.002)	(0.003)	(0.001)	(0.011)	(0.000)

Table 23 Adjusted R^2 for Residential Segregation by GPA

	1996	1997	1998	1999	2000	2001	2002	2003	2004

Helsinki	0.028	-0.007	0.017	0.025	0.027	0.021	0.027	0.022	0.027
	(0.009)	(0.008)	(0.008)	(0.009)	(0.008)	(0.007)	(0.009)	(0.008)	(0.009)
Vantaa	-0.007	-0.012	0.002	0.007	0.008	-0.002	0.001	-0.012	0.002
	(0.008)	(0.011)	(0.012)	(0.011)	(0.010)	(0.009)	(0.009)	(0.010)	(0.010)
Espoo	0.012	-0.009	-0.002	0.018	0.022	0.009	0.006	0.016	0.020
	(0.011)	(0.010)	(0.008)	(0.010)	(0.012)	(0.009)	(0.011)	(0.009)	(0.011)
Turku	0.024	-0.010	0.007	0.000	0.006	0.023	0.015	0.002	0.002
	(0.015)	(0.015)	(0.011)	(0.008)	(0.009)	(0.014)	(0.014)	(0.010)	(0.011)
Tampere	0.001	-0.003	0.008	0.010	0.017	0.017	0.025	0.018	0.014
	(0.008)	(0.017)	(0.016)	(0.012)	(0.013)	(0.018)	(0.016)	(0.014)	(0.015)
Seinäjoki	0.032	-0.047	-0.011	-0.013	-0.002	-0.019	-0.028	-0.012	-0.014
	(0.028)	(0.007)	(0.015)	(0.010)	(0.015)	(0.009)	(0.004)	(0.012)	(0.012)
Oulu	-0.009	-0.027	0.001	0.001	-0.008	-0.006	-0.009	-0.008	-0.004
	(0.007)	(0.008)	(0.010)	(0.009)	(0.006)	(0.007)	(0.008)	(0.009)	(0.007)
Jyväskylä	0.034	0.010	-0.002	0.039	0.007	0.001	0.054	-0.010	0.034
	(0.022)	(0.023)	(0.013)	(0.030)	(0.013)	(0.012)	(0.041)	(0.011)	(0.032)
Imatra	-0.011	-0.030	0.022	0.037	0.006	0.012	-0.017	0.050	0.002
	(0.013)	(0.009)	(0.022)	(0.022)	(0.019)	(0.014)	(0.014)	(0.022)	(0.019)
Heinola	0.012	0.019	-0.001	-0.026	0.005	0.045	-0.009	-0.036	0.014
	(0.018)	(0.041)	(0.021)	(0.004)	(0.014)	(0.049)	(0.029)	(0.002)	(0.031)
Nokia	-0.004	-0.025	-0.020	0.003	-0.027	-0.026	-0.039	-0.033	-0.024
	(0.018)	(0.023)	(0.010)	(0.014)	(0.005)	(0.006)	(0.002)	(0.004)	(0.006)
Riihimäki	-0.013	0.525	-0.022	-0.016	-0.019	-0.016	-0.019	-0.026	-0.032
	(0.008)	(0.157)	(0.007)	(0.010)	(0.005)	(0.020)	(0.008)	(0.012)	(0.003)
Naantali	-0.026	-0.052	-0.038	-0.010	-0.034	0.005	-0.040	-0.022	-0.038
	(0.006)	(0.003)	(0.000)	(0.013)	(0.000)	(0.021)	(0.001)	(0.010)	(0.002)

Table 24 Adjusted R^2 for Residential Segregation by GPA of Theoretical Subjects

	1996	1997	1998	1999	2000	2001	2002	2003	2004
Helsinki	0.030	-0.006	0.017	0.026	0.029	0.023	0.026	0.025	0.029
	(0.008)	(0.008)	(0.008)	(0.009)	(0.009)	(0.008)	(0.009)	(0.009)	(0.009)
Vantaa	-0.005	-0.012	0.002	0.008	0.008	-0.001	0.003	-0.009	0.004
	(0.008)	(0.011)	(0.011)	(0.011)	(0.009)	(0.010)	(0.010)	(0.010)	(0.011)
Espoo	0.012	-0.006	-0.004	0.016	0.022	0.004	0.006	0.017	0.019
	(0.012)	(0.011)	(0.008)	(0.010)	(0.012)	(0.008)	(0.011)	(0.009)	(0.011)
Turku	0.018	-0.013	0.005	-0.003	0.006	0.022	0.010	0.001	0.003
	(0.014)	(0.013)	(0.011)	(0.007)	(0.010)	(0.015)	(0.014)	(0.010)	(0.012)
Tampere	-0.004	-0.009	0.007	0.004	0.010	0.016	0.023	0.020	0.015
	(0.007)	(0.014)	(0.016)	(0.011)	(0.012)	(0.018)	(0.017)	(0.014)	(0.015)
Seinäjoki	0.016	-0.049	-0.008	-0.015	0.000	-0.014	-0.030	-0.018	-0.015
	(0.021)	(0.007)	(0.017)	(0.009)	(0.014)	(0.014)	(0.004)	(0.009)	(0.011)
Oulu	-0.008	-0.028	0.002	0.001	-0.009	-0.007	-0.012	-0.011	-0.008
	(0.007)	(0.008)	(0.012)	(0.009)	(0.006)	(0.007)	(0.008)	(0.008)	(0.007)
Jyväskylä	0.034	0.001	-0.004	0.034	-0.002	0.003	0.039	-0.011	0.026
	(0.022)	(0.021)	(0.011)	(0.026)	(0.011)	(0.013)	(0.035)	(0.010)	(0.030)
Imatra	-0.008	-0.033	0.021	0.025	0.003	0.006	-0.017	0.039	-0.003
	(0.014)	(0.009)	(0.022)	(0.017)	(0.018)	(0.013)	(0.013)	(0.020)	(0.017)
Heinola	0.028	0.008	0.006	-0.024	0.005	0.037	-0.007	-0.034	0.003
	(0.025)	(0.034)	(0.026)	(0.005)	(0.015)	(0.046)	(0.031)	(0.002)	(0.024)
Nokia	-0.005	-0.025	-0.018	-0.017	-0.024	-0.022	-0.037	-0.033	-0.027
	(0.018)	(0.022)	(0.011)	(0.007)	(0.006)	(0.008)	(0.002)	(0.003)	(0.007)
Riihimäki	-0.008	0.528	-0.022	-0.020	-0.020	-0.012	-0.022	-0.025	-0.033
	(0.010)	(0.161)	(0.007)	(0.008)	(0.005)	(0.019)	(0.007)	(0.012)	(0.004)
Naantali	-0.026	-0.054	-0.038	-0.013	-0.035	0.004	-0.038	-0.008	-0.039
	(0.007)	(0.002)	(0.000)	(0.011)	(0.000)	(0.021)	(0.002)	(0.017)	(0.001)

Table 25 Adjusted R^2 for Residential Segregation by High School Attendance

	1996	1997	1998	1999	2000	2001	2002	2003	2004
Helsinki	0.013	0.006	0.006	0.010	0.011	0.010	0.013	0.008	0.021
	(0.009)	(0.005)	(0.007)	(0.008)	(0.007)	(0.007)	(0.008)	(0.007)	(0.011)
Vantaa	-0.008	-0.009	-0.006	0.009	0.005	0.009	-0.007	-0.014	-0.008
	(0.006)	(0.007)	(0.008)	(0.011)	(0.013)	(0.010)	(0.006)	(0.008)	(0.007)
Espoo	-0.002	0.015	-0.006	0.003	0.000	-0.008	-0.004	-0.005	0.012
	(0.007)	(0.012)	(0.009)	(0.009)	(0.007)	(0.006)	(0.009)	(0.007)	(0.011)
Turku	0.026	0.016	-0.007	-0.004	-0.008	0.002	0.028	-0.013	0.007
	(0.015)	(0.017)	(0.008)	(0.008)	(0.010)	(0.013)	(0.019)	(0.008)	(0.011)
Tampere	-0.010	-0.008	-0.006	-0.007	-0.006	0.003	0.004	0.005	0.011
	(0.005)	(0.006)	(0.008)	(0.007)	(0.006)	(0.009)	(0.011)	(0.012)	(0.016)
Seinäjoki	0.002	-0.009	0.009	-0.013	-0.001	0.003	-0.030	-0.035	-0.011
	(0.016)	(0.013)	(0.018)	(0.010)	(0.013)	(0.020)	(0.004)	(0.002)	(0.011)
Oulu	-0.016	-0.008	-0.003	-0.017	-0.019	-0.014	-0.012	-0.010	-0.016
	(0.006)	(0.009)	(0.011)	(0.006)	(0.004)	(0.008)	(0.009)	(0.009)	(0.008)
Jyväskylä	0.025	0.006	-0.003	0.017	-0.001	0.005	0.017	-0.010	-0.002
	(0.017)	(0.016)	(0.012)	(0.015)	(0.012)	(0.014)	(0.023)	(0.010)	(0.015)
Imatra	-0.017	-0.015	0.013	0.010	0.027	-0.011	0.005	0.008	-0.001
	(0.011)	(0.008)	(0.014)	(0.013)	(0.023)	(0.010)	(0.018)	(0.020)	(0.016)
Heinola	0.032	-0.028	-0.008	-0.027	0.018	0.011	-0.018	-0.034	-0.002
	(0.027)	(0.004)	(0.024)	(0.003)	(0.024)	(0.027)	(0.018)	(0.003)	(0.018)
Nokia	-0.023	-0.012	-0.032	-0.002	-0.024	-0.024	-0.022	-0.031	-0.017
	(0.006)	(0.008)	(0.004)	(0.013)	(0.006)	(0.007)	(0.011)	(0.003)	(0.011)
Riihimäki	0.000	0.008	-0.005	-0.018	-0.023	-0.007	-0.008	-0.022	-0.032
	(0.012)	(0.026)	(0.011)	(0.012)	(0.008)	(0.025)	(0.013)	(0.016)	(0.004)
Naantali	-0.026	-0.033	-0.035	-0.018	-0.033	-0.005	-0.033	-0.028	-0.031
	(0.009)	(0.001)	(0.002)	(0.009)	(0.001)	(0.016)	(0.004)	(0.007)	(0.004)

Table 26 Adjusted R^2 for Residential Segregation by High School Graduates

	1996	1997	1998	1999	2000	2001	2002	2003	2004
Helsinki	0.036	0.041	0.030	0.040	0.030	0.031	0.036	0.037	0.040
	(0.011)	(0.011)	(0.009)	(0.011)	(0.010)	(0.009)	(0.011)	(0.010)	(0.013)
Vantaa	0.000	0.003	-0.002	0.021	0.023	0.003	0.001	0.001	0.005
	(0.010)	(0.009)	(0.009)	(0.014)	(0.012)	(0.011)	(0.008)	(0.012)	(0.011)
Espoo	0.015	0.030	0.026	0.023	0.034	0.007	0.032	0.024	0.031
	(0.009)	(0.013)	(0.014)	(0.011)	(0.013)	(0.009)	(0.015)	(0.012)	(0.013)
Turku	0.027	0.010	0.011	0.019	-0.001	0.021	0.030	-0.005	0.021
	(0.015)	(0.013)	(0.015)	(0.013)	(0.011)	(0.017)	(0.015)	(0.010)	(0.014)
Tampere	0.012	0.005	0.009	0.009	0.029	0.026	0.027	0.032	0.030
	(0.008)	(0.010)	(0.013)	(0.012)	(0.020)	(0.015)	(0.018)	(0.016)	(0.022)
Seinäjoki	0.010	-0.010	-0.011	-0.008	-0.006	0.017	-0.012	-0.033	-0.004
	(0.016)	(0.012)	(0.012)	(0.011)	(0.011)	(0.024)	(0.009)	(0.003)	(0.014)
Oulu	-0.010	0.002	0.017	0.000	-0.008	-0.009	-0.018	0.003	-0.013
	(0.006)	(0.010)	(0.015)	(0.010)	(0.006)	(0.008)	(0.007)	(0.012)	(0.006)
Jyväskylä	0.034	0.015	-0.002	0.019	0.001	0.012	0.042	-0.009	0.025
	(0.022)	(0.022)	(0.010)	(0.017)	(0.012)	(0.017)	(0.031)	(0.013)	(0.031)
Imatra	-0.010	-0.022	0.013	0.013	0.003	-0.011	-0.009	0.058	0.004
	(0.017)	(0.005)	(0.015)	(0.020)	(0.013)	(0.009)	(0.016)	(0.034)	(0.026)
Heinola	0.054	-0.019	-0.014	-0.009	0.000	0.046	-0.016	-0.016	-0.013
	(0.040)	(0.011)	(0.016)	(0.009)	(0.015)	(0.042)	(0.015)	(0.018)	(0.016)
Nokia	-0.027	0.003	-0.034	-0.022	-0.017	-0.003	-0.028	-0.033	-0.008
	(0.003)	(0.018)	(0.002)	(0.006)	(0.008)	(0.016)	(0.006)	(0.003)	(0.020)
Riihimäki	0.013	-0.032	-0.015	-0.031	-0.019	-0.009	-0.017	-0.024	-0.031
	(0.020)	(0.001)	(0.007)	(0.003)	(0.011)	(0.024)	(0.011)	(0.015)	(0.008)
Naantali	-0.023	-0.035	-0.024	-0.021	-0.031	-0.032	-0.040	-0.020	-0.040
	(0.005)	(0.000)	(0.007)	(0.007)	(0.002)	(0.003)	(0.001)	(0.011)	(0.000)

Table 27 Adjusted Duncan Index for Residential Segregation by Foreign Language

	1996	1997	1998	1999	2000	2001	2002	2003	2004
Helsinki	-0.008	-0.056	-0.104	-0.064	-0.161	0.087	-0.196	0.049	0.062
	(0.155)	(0.176)	(0.318)	(0.115)	(0.138)	(0.177)	(0.267)	(0.129)	(0.124)
Vantaa	-0.099	-0.003	-0.188	-0.014	-0.185	0.148	-0.248	-0.016	-0.005
	(0.225)	(0.149)	(0.125)	(0.469)	(0.149)	(0.081)	(0.124)	(0.076)	(0.145)
Espoo	-0.185	-0.090	-0.250	-0.096	-0.082	0.128	-0.141	0.128	0.210
	(0.226)	.	.	(0.193)	(0.145)	(0.104)	(0.088)	(0.102)	.
Turku	-0.041	0.129	-0.089	0.078	-0.159	0.238	-0.048	0.010	0.100
	.	(0.389)	(0.759)	(0.191)	(0.275)	.	(0.732)	(0.000)	(0.185)
Tampere	0.296	0.134	0.109	-0.039	0.038	0.328	-0.029	0.135	0.102
	(0.321)	(0.462)	(0.306)	(0.368)	(0.214)	(0.349)	(0.702)	(0.386)	(0.260)
Seinäjoki	0.357	0.233	0.457	0.645	0.753	0.562	0.683	0.531	0.344
	(0.470)	(0.387)	(0.480)	(0.617)	(0.695)	(0.279)	(0.667)	(0.354)	(0.265)
Oulu	0.511	0.402	0.305	0.525	0.190	0.288	-0.031	0.134	0.320
	(0.189)	(0.166)	(0.171)	(0.198)	(0.201)	(0.099)	(0.099)	.	(0.118)
Jyväskylä	0.355	0.142	-0.022	-0.088	0.047	0.165	-0.185	0.076	0.134
	(0.187)	.	.	(0.177)	(0.072)	(0.083)	(0.302)	.	(0.139)
Imatra	-0.199	0.432	0.187	0.840	-0.010	0.233	0.450	0.231	0.201
	(0.305)	(0.353)	(0.608)	(0.346)	(0.483)	(0.288)	(0.453)	(0.256)	(0.244)
Heinola	0.043	-0.030	0.005	0.507	0.704	0.336	-0.375	-0.294	-0.026
	(0.455)	(0.247)	(0.436)	(0.462)	(0.718)	(0.281)	(0.270)	(0.201)	(0.296)
Nokia	0.184	-0.798	-0.001	0.348	0.528	-0.396	0.776	0.723	0.208
	(0.431)	(0.401)	(0.352)	(0.223)	(0.445)	(0.000)	(0.099)	(0.251)	(0.276)
Riihimäki	0.444	0.335	-0.237	-0.412	-0.216	-0.141	0.571	0.437	0.516
	(0.495)	(0.431)	(0.138)	(0.144)	(0.164)	(0.149)	(0.407)	(0.349)	(0.426)
Naantali	-0.794	-0.171	-0.821	0.432	-0.564	-0.396	-0.054	-0.501	-0.480
	(0.000)	(0.405)	(0.788)	(0.489)	(0.235)	(0.000)	(0.593)	(0.000)	(0.000)

Table 28 Adjusted Isolation Index for Residential Segregation by Foreign Language

	1996	1997	1998	1999	2000	2001	2002	2003	2004
Helsinki	-0.006	-0.002	-0.015	-0.012	-0.016	-0.011	-0.024	-0.013	-0.005
	(0.067)	(0.046)	(0.068)	(0.039)	(0.032)	(0.041)	(0.051)	(0.092)	(0.034)
Vantaa	-0.034	-0.029	-0.037	-0.008	-0.035	-0.014	-0.037	-0.024	-0.023
	(0.020)	(0.025)	(0.023)	(0.033)	(0.028)	(0.029)	(0.059)	(0.029)	(0.057)
Espoo	-0.034	-0.017	-0.031	-0.028	-0.023	-0.023	-0.036	-0.022	-0.019
	(0.135)	.	.	(0.015)	(0.022)	(0.029)	(0.027)	(0.034)	.
Turku	-0.007	0.010	-0.016	-0.012	-0.016	0.007	-0.003	-0.010	0.006
	.	(0.005)	(0.026)	(0.017)	(0.018)	.	(0.027)	(0.000)	(0.061)
Tampere	-0.017	-0.023	-0.029	-0.039	-0.015	-0.011	-0.024	-0.021	-0.035
	(0.026)	(0.047)	(0.020)	(0.019)	(0.071)	(0.040)	(0.029)	(0.042)	(0.029)
Seinäjoki	-0.040	-0.035	-0.046	-0.026	-0.043	0.001	-0.060	-0.051	-0.050
	(0.005)	(0.010)	(0.006)	(0.019)	(0.010)	(0.028)	(0.008)	(0.013)	(0.014)
Oulu	-0.022	-0.015	-0.025	-0.034	-0.030	-0.014	-0.052	-0.059	-0.036
	(0.007)	(0.058)	(0.010)	(0.014)	(0.071)	(0.023)	(0.009)	.	(0.010)
Jyväskylä	-0.029	-0.039	-0.038	-0.032	-0.030	-0.036	-0.058	-0.046	0.006
	(0.007)	.	.	(0.015)	(0.019)	(0.077)	(0.157)	.	(0.039)
Imatra	-0.037	-0.037	-0.040	0.002	-0.042	-0.035	0.013	-0.046	0.025
	(0.008)	(0.005)	(0.016)	(0.144)	(0.017)	(0.018)	(0.389)	(0.012)	(0.007)
Heinola	-0.033	-0.034	-0.042	-0.026	-0.035	0.003	-0.063	-0.045	-0.052
	(0.013)	(0.021)	(0.015)	(0.014)	(0.015)	(0.044)	(0.006)	(0.017)	(0.020)
Nokia	-0.041	.	-0.052	-0.017	-0.030	.	-0.045	-0.044	-0.054
	(0.005)	.	(0.003)	(0.015)	(0.017)	.	(0.000)	(0.030)	(0.012)
Riihimäki	0.007	-0.039	-0.045	-0.048	-0.050	-0.052	-0.044	-0.037	-0.062
	(0.035)	(0.010)	(0.011)	(0.008)	(0.009)	(0.004)	(0.016)	(0.020)	(0.010)

Naantali	.	-0.052	.	-0.045	-0.060	.	-0.069	.	.
	.	(0.005)	.	(0.020)	(0.012)	.	(0.019)	.	.

Table 29 Adjusted R^2 for Residential Segregation by Foreign Language

	1996	1997	1998	1999	2000	2001	2002	2003	2004
Helsinki	0.009	0.018	0.006	0.011	0.008	0.017	0.007	0.023	0.034
	(0.005)	(0.007)	(0.006)	(0.006)	(0.007)	(0.008)	(0.007)	(0.011)	(0.011)
Vantaa	-0.017	-0.009	-0.015	0.013	-0.010	0.016	-0.006	0.012	0.016
	(0.003)	(0.006)	(0.005)	(0.012)	(0.006)	(0.014)	(0.008)	(0.015)	(0.012)
Espoo	-0.018	0.001	-0.010	-0.006	0.002	0.006	-0.005	0.013	0.020
	(0.003)	(0.010)	(0.011)	(0.011)	(0.008)	(0.009)	(0.008)	(0.012)	(0.008)
Turku	0.009	0.029	0.005	0.009	0.008	0.035	0.027	0.025	0.045
	(0.011)	(0.017)	(0.012)	(0.009)	(0.013)	(0.015)	(0.018)	(0.020)	(0.024)
Tampere	-0.001	-0.005	-0.007	-0.019	0.009	0.017	0.005	0.014	0.005
	(0.013)	(0.007)	(0.006)	(0.004)	(0.012)	(0.011)	(0.014)	(0.014)	(0.011)
Seinäjoki	-0.023	-0.015	-0.024	-0.004	-0.018	0.029	-0.029	-0.015	-0.010
	(0.003)	(0.009)	(0.003)	(0.005)	(0.002)	(0.018)	(0.002)	(0.008)	(0.010)
Oulu	-0.006	0.004	-0.004	-0.012	-0.006	0.015	-0.021	-0.022	0.003
	(0.006)	(0.008)	(0.007)	(0.004)	(0.011)	(0.016)	(0.006)	(0.003)	(0.008)
Jyväskylä	-0.012	-0.018	-0.016	-0.010	-0.005	-0.006	-0.027	-0.010	0.043
	(0.005)	(0.008)	(0.007)	(0.008)	(0.009)	(0.009)	(0.007)	(0.011)	(0.038)
Imatra	-0.021	-0.017	-0.018	0.023	-0.017	-0.008	0.042	-0.010	0.062
	(0.007)	(0.005)	(0.009)	(0.014)	(0.009)	(0.019)	(0.031)	(0.008)	(0.070)
Heinola	-0.017	-0.013	-0.020	-0.004	-0.011	0.032	-0.031	-0.035	-0.012
	(0.009)	(0.009)	(0.013)	(0.009)	(0.004)	(0.028)	(0.008)	(0.004)	(0.014)
Nokia	-0.024	.	-0.030	0.008	-0.005	.	-0.014	-0.007	-0.013
	(0.003)	.	(0.004)	(0.016)	(0.016)	.	(0.004)	(0.006)	(0.011)
Riihimäki	0.022	-0.029	-0.021	-0.025	-0.024	-0.028	-0.011	0.003	-0.022
	(0.013)	(0.002)	(0.006)	(0.006)	(0.004)	(0.002)	(0.009)	(0.017)	(0.003)
Naantali	.	-0.031	.	-0.023	-0.034	.	-0.038	.	.
	.	(0.001)	.	(0.005)	(0.001)	.	(0.002)	.	.