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Evidence from policy reforms

Anna Makles
Kerstin Schneider

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Segregation in primary schools – Do school districts really matter? Evidence from policy reforms[1]

Anna Makles and Kerstin Schneider

University of Wuppertal

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Abstract

This paper analyzes the effect of the abolition of school districts in North-Rhine Westphalia on ethnic segregation in primary schools, using data from the school statistics from 2006/07 to 2008/09. The effect of the new policy is not easily identified, because several additional changes to the school law and nationality law have also affected segregation. We propose using a measure of systematic segregation and a Wald test in order to test for differences in systematic segregation and to estimate a random effects model to explain differences in systematic segregation across municipalities. The ethnic groups analyzed are Turkish and non-Turkish students, non-German and German students, and Muslim and non-Muslim students. It is shown that abolishing school districts has not increased systematic segregation in primary schools. However, segregation has been affected by policy changes other than the abolition of school districts.

Keywords: School choice; policy reform; systematic segregation; dissimilarity index; school districts

JEL Classification: H75; I21; I28; J15

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1. Introduction

During the last decade, several changes to the German educational system were discussed and put into practice. The main objective of the reforms was to improve the academic performance of students. However, apart from the level of academic achievement, social and ethnic disparity is an acknowledged weakness of the German school system. A child's socio-economic background is a better predictor of educational achievement in Germany than in many other countries. Hence, another objective of educational policy in Germany is to assist disadvantaged groups in obtaining better education.

To this end, a possible trade-off between performance and equity is often discussed. In particular, when issues of school choice are on the agenda, there is no easy answer. This paper contributes to the debate by analyzing the effects of increased school choice, resulting from the abolition of primary school districts, on ethnic segregation in North-Rhine Westphalia (NRW), the most populous German federal state. In 2005 NRW passed a new school law abolishing primary school districts in all 396 municipalities by the 2008/09 school year. Hence, parents in NRW – unlike their counterparts in other German federal states – have been allowed to choose a primary school independent of their place of residence since 2008. The intention of this new regulation was to increase parental school choice and to foster competition between schools. The most frequently-cited argument against free school choice, however, is the fear of increased segregation and educational disparity.

Until recently, school choice has not been a prominent issue in educational policy and research in Germany. It is commonly thought that there is no school choice at the primary school level, with the focus of research thus lying more on choice in secondary schooling (Dustmann, 2004). It is less known that even before 2008, it was not uncommon to opt out of one's assigned primary school in NRW (Kristen, 2005; Riedel et al., 2010; Schneider et al., 2011). Thus, it is quite surprising that only very little research on primary school choice in Germany has been conducted.

We intend to contribute to the literature on school choice by analyzing the effects of a far-reaching educational policy experiment, i.e. the abolition of school districts, on ethnic segregation.

In the international literature, school choice has drawn considerable attention. Choice is thought to have a positive impact on competition between schools and might

therefore increase the quality of schooling (Hoxby, 2003; Figlio and Hart, 2010). However, whether school choice does, in fact, increase student achievement remains a matter of debate (Cullen, Jacob, and Levitt, 2005). The main intention of increasing school choice by introducing charter school programs was to reduce racial and social segregation and to improve the educational opportunities of more disadvantaged groups (Hanushek, Kain, and Rivkin, 2009; Hastings and Weinstein, 2008; Fryer and Levitt, 2004). However, the results of many studies suggest the opposite, as increased school choice also has potentially negative effects (Lankfort and Wyckoff, 2001; Bifulco, Ladd, and Ross, 2009). School choice tends to increase social and ethnic segregation rather than decrease it (Burgess and Briggs, 2006). Walsh (2009) does not argue against these findings, but claims that even without choice within-school heterogeneity is so low that cream-skimming of the remaining high-ability children would not have a sizable effect on those left behind. Urquiola (2005) points out that differences in the composition and distribution of students in public schools result not only from school choice, but also from the different number of school districts in any given metropolitan area. Increases in the number of districts in a metropolitan area result in a more homogeneous school district population (i.e. increased Tiebout choice), hence reducing private enrollment.

As Bourdieu (1986) argues, school choice is less common in disadvantaged families due to limited economic, cultural, and social resources. Accordingly, a number of studies have shown that choice is practiced primarily by socioeconomically advantaged, better-educated individuals. Low-income families, in contrast, attach higher value to proximity when choosing schools, because of the importance of travel costs (O'Shaughnessy, 2007). Confirming the findings of international studies for Germany, Schneider et al. (2011) show that while disadvantaged students are less likely to opt out of their assigned school, they also benefit from more choice. Choice depends on the student's ethnicity and distance from school, the academic quality of the school, and the socioeconomic composition of the school.

Only few studies address the effect of changes in educational policy on segregation. Söderström and Uusitalo (2010) analyze the change in the admission system of public upper secondary schools in Stockholm. Before 2000, proximity to school was the main criterion for being admitted to any given school. Since 2000, however, admission has been based on student ability only. Söderström and Uusitalo's

results indicate that school segregation based on family background as well as ethnicity has increased significantly since 2000. However, the study does not determine whether this increased segregation is caused by parental choice or by the admittance strategy of schools or both. Machin and Salvanes (2010) use evidence from a change in school choice policy in Oslo County to identify the impact of school quality on house prices. They confirm that parents, in fact, do value better-performing schools and are willing to pay higher prices for homes close to better schools. Once the system of rigid catchment areas was abandoned, however, the link between house prices and school performance was significantly weakened. Lastly, Lavy (2010) evaluates a program in which inter-district busing integration was replaced by free school choice between schools within and outside of districts in Tel Aviv. His findings suggest that free school choice has led to an improved matching of student to school, resulting in increased achievement.

This paper aims to achieve a better understanding of the effects of introducing free primary school choice in North Rhine-Westphalia on segregation. Unlike the study by Schneider et al. (2011), we do not use data at the individual level for one municipality; instead, we use the data from the school statistics for all municipalities in NRW aggregated on the school/grade level. This allows more general conclusions to be drawn. Our focus is on the children of immigrant families, which are known to be disadvantaged in the German educational system. However, as information on ethnicity is not readily available in the official school statistics, we make use of the children's citizenship and denomination to differentiate between those who belong to advantaged groups and those who belong to disadvantaged groups. In particular, we distinguish between Turkish and non-Turkish students, non-German and German students, and Muslim and non-Muslim students. We propose using a measure of systematic segregation and a Wald test in order to test for differences in systematic segregation. Our analysis shows that abolishing school districts has not significantly increased systematic segregation in primary schools. However, segregation has been affected by policy changes other than the abolition of school districts.

This paper is organized as follows: In Section 2 we discuss the institutional details of primary school choice in NRW. The data is described in Section 3, and in Section 4 we explain our empirical strategy. The results are presented in Section 5, and Section 6 concludes the paper.

2. School Choice in NRW: Institutional Background

Before the 2008/09 school year, choice in German primary schools appears to have been rather limited. Students were assigned to a public school (Gemeinschaftsgrundschule) in their school district. However, choice was not as limited as it initially appears to have been. First, parents could apply for permission to attend a different school (§ 39 SchulG NRW [NRW School Law]). They had to present a convincing argument, such as the presence of a child care provider in another school district. Neither school quality nor the social composition of the school were accepted arguments. The parents' application was discussed by the principals of the chosen school and the assigned school. The final decision was made by the school authorities. To our knowledge, there is no research conducted before 2008 that analyzes the authorities' granting and denying of permission to attend a public primary school other than the one assigned. Second, there are public denominational schools (oeffentliche Bekenntnisschulen). Public schools and public denominational schools do not charge tuition and are fully publicly funded. In the following, we simply label them public schools and denominational schools. In addition to the public and denominational schools, there is a rather small number of private primary schools, which will, however, be disregarded in this study. Private schools might charge tuition and are often Waldorf schools, Montessori schools or private denominational schools with a strong focus on religious education. Private denominational schools are partially funded by the church, which is not the case with public denominational schools in NRW. Children in NRW have the right to attend a denominational school in their municipality or a neighboring municipality if the child belongs to that denomination (§ 26 SchulG NRW). A child might also be admitted to a denominational school even if that child does not belong to the school's denomination, in cases where parents wish their child to be educated according to that denomination. This is clearly a soft condition which is not verifiable and which leaves room for interpretation. Moreover, children of a different denomination might be admitted to a denominational school if there is no school of the child's denomination within a reasonable distance from the child's home.

Since the 2008/09 school year, school districts for primary schools have been abolished in NRW. Theoretically, this should give parents free choice of school; in practice, however, this is not necessarily the case. First, the amount of information given to parents is limited. Parents of school-age children receive a letter from the local

school authority informing them that they have to enroll their child, and they are given the address of the nearest school. Most, but not all, primary schools have a homepage with information about the school; however, indicators of the achievement level of the schools are not published at all. Second, the schools are given fairly strict legal guidelines on how to determine admission, with distance to the chosen school being the most important restriction. It is explicitly stated in the revised school law that students have the right to be admitted to the closest school of the chosen school type (public or denominational) if the capacity of the school permits (§ 46 SchulG NRW). Interestingly – and this is not a result of the school reform – the NRW constitution explicitly rules out family background as a criterion for admission to a school (Art. 10 LV NRW). A third point to note is that, due to demographic change, the number of school aged children is decreasing in NRW, leaving more room for choice and also for increased competition between schools. In 2010, a new state government was elected in NRW, and the new government plans to reestablish school districts, passing a law in December of 2010 allowing the municipalities to reestablish school districts.

3. The Data

The data used to analyze ethnic segregation in primary schools is from the NRW school statistics and covers the 2006/07, 2007/08, and 2008/09 school years. All information is aggregated at the grade/school level and shown in Table 1. NRW has 3,421 primary schools in 2006/07, almost all of which are public schools (3,392). The number of schools decreases in 2007/08 (2008/09) to 3,368 (3,266), because some schools have been closed due to the decreasing number of children. In the following analysis, private schools are not included, as they are not directly affected by the existence of school districts and only play a minor role in the NRW school system.

(Table 1 about here)

As described in Section 2, NRW allows for public denominational primary schools. The denominational schools in NRW are important with respect to school choice and segregation analysis, as they offer parents choice options even in the presence of school districts. Note that denominational schools have larger school districts than public schools, because there are typically fewer denominational schools than public schools.

For example, Dortmund (one of the largest cities in NRW), has 11 Catholic schools and 81 public schools in 2006/07. Hence, one denominational school district in Dortmund comprises almost 8 public school districts on average. Not every community in NRW, however, has both school types. Only about 57% of all municipalities have public and denominational schools. 74 municipalities have denominational schools only, and 95 municipalities have no denominational schools. The distribution of school types in NRW is shown in Figure 1(a). The white areas represent municipalities with denominational schools only, while the black areas represent municipalities with public schools only. As Figure 1(b) illustrates, the mix of both school types is typical for regions with a higher school density (i.e. the darker areas). Those regions are also more densely populated.

(Figure 1 about here)

As this paper focuses on ethnic segregation before and after abolishing school districts in NRW, we need to define the ethnic minority group(s) for which segregation is to be analyzed. The school statistics yield information on school composition by citizenship, which can be used as an indicator for ethnicity. However, after the modification of the nationality law (StAG), children with non-German parents born in Germany after January 1st, 2000 become German citizens if at least one parent has been living in Germany for at least 8 years (according to the main residence clause of the nationality law) and has a permanent right to reside in Germany. This amendment has led to a decrease in the non-German school aged population, which might well affect indicators of ethnic segregation.

Figure 2 shows the number of births in North-Rhine Westphalia (NRW) from 1990 to 2008. The upper time series (i.e. the solid line) shows the total number of births, while the other lines indicate births by nationality (either German or non-German). Apparently, the total number of births is decreasing over time. While the number of births of German citizens is also decreasing over time, there is a distinct increase in German births in 2000; this increase is mirrored by a decrease in non-German births. Since 2001, there has been a continuing downward trend in number of births for both groups. Hence, as expected, the number of 1st grade students decreases from 174,310 in 2006/07 to 161,615 in 2008/09; likewise, the number and proportion of non-German

students is steadily shrinking, from 13.6% in 2006/07 to 11.1% in 2008/09 (Table 1). The proportion of Turkish students decreases from 6.6% in 2006/07 to 4.6% in 2008/09.

(Figure 2 about here)

Since the change, nationality is no longer a reliable indicator of a migrant background and information on the child's ethnicity is not collected. Hence, we use an additional proxy variable to distinguish ethnic groups. One possible variable that can serve as a proxy for ethnic minorities is the denominational information. Because the largest non-German group in NRW is from Turkey and other Arab countries, we use the denomination Muslim as a proxy for ethnicity, as the large majority of this group is Muslim. While the number of non-German and Turkish students, as well as the proportion of these students, is decreasing over time, the number of Muslim students remains constant, and the proportion of Muslim students is even increasing (Table 1). As some authors have pointed out, parents belonging to minority groups (like Muslims) exhibit school choice less often, rather opting to attend the assigned school. Hence, an increasing proportion of Muslim students might reduce the overall likelihood of exercising school choice within the general population of students, thereby affecting segregation in primary schools.

In addition to the abolition of school districts and the change in the nationality law, there is a third policy change that has to be accounted for in the analysis. Until the 2006/07 school year, the cutoff date for enrollment was June 30th. Children born between July 1st, 1999 and June 30th, 2000 are required to enroll in 2006/07. The 2007/08 school year, however, saw the beginning of a gradual shifting of the cutoff date for enrollment, a process which will be completed in the 2014/15 school year, at which time the cutoff date will be December 31st. This adjustment is relevant for our analysis, as more children will have to be enrolled in the 2007/08 school year (Figure 3, Table 1), and it cannot simply be assumed that these additional children will be allocated randomly across schools.

(Figure 3 about here)

To summarize, changes in the nationality law and the new cutoff date, as well as the general demographic change, might affect segregation, regardless of the abolition of school districts.

Finally, as 15 of the 396 municipalities already voluntarily abolished their school districts in 2007/08, there are two subsamples to be analyzed: one which contains municipalities which abolished school districts early, and a second with municipalities which did not. Therefore, we are able to analyze the changes in segregation one year before, and two years after the abolition of school districts for 15 municipalities. For the majority of municipalities, however, this analysis of segregation encompasses the period of time two years before, and one year after the abolition of school districts.

4. Empirical strategy

To measure segregation, we build on the dissimilarity measure *D* (Duncan and Duncan, 1955). We decided to use *D* as a starting point for two reasons. First, *D* is the most popular measure of dissimilarity and segregation. The formula for D_t is given by

$$D_t = \frac{1}{2}\sum_{j=1}^{J}\left|\frac{n_{j1t}}{n_{1t}} - \frac{n_{j0t}}{n_{0t}}\right|. \qquad (1)$$

D_t is bounded between 0 and 1, and corresponds to the percentage of individuals (students) who have to change schools to achieve an equal distribution. The units (primary schools) are denoted by $j = 1,\ldots,J$, and t is the time index. Furthermore, we distinguish between two types of individuals: minority and non-minority individuals. The first type has the minority status $g = 1$, while the second type has the non-minority status $g = 0$. Hence, the number of individuals of type g in unit j at time t is given by n_{jgt}, and the total number of individuals in unit j at time t is $n_{jt} = n_{j1t} + n_{j0t}$.

The second reason for using D_t is that – unlike other measures of segregation – it is possible to test for equality of segregation (Ransom, 2000; Allen, Burgess, and Windmeijer, 2009). This is done by means of a Wald test. Under the null hypothesis the test statistic is given by

$$W = \frac{\left(D_1 - D_2\right)^2}{\hat{V}(D_1) + \hat{V}(D_2)}, \qquad (2)$$

where W is asymptotically χ_1^2-distributed.

Despite the popularity of the dissimilarity index and related measures in empirical work, these indices nonetheless suffer from severe shortcomings. As known from the literature (Carrington and Troske, 1997; Cortese, Falk, and Cohen, 1976), the most common indices of segregation indicate substantial segregation even when the population is randomly allocated across units. As segregation indices are quite sensitive when group sizes and minority proportions are small, we need to account for changes in group size.

Allen, Burgess and Windmeijer (2009) propose a bias corrected dissimilarity measure D_{bc} to account for small group sizes and small proportions of minorities by calculating bootstrap versions of D and its variance. The bias corrected segregation measure is given by $D_{bc} = D - (\bar{D}_b - D)$, where $\bar{D}_b$ is the mean of b bootstrap calculations of the dissimilarity measure D. To generate the bootstrap sample, they randomly allocate the individuals to the units, holding the number of individuals and the proportions of the individuals constant. Consequently, the unit size – in our example, the school size – may vary. We decided not to follow this strategy, but to modify the random allocation process by allowing the minority proportions in each unit to vary while, however, holding the unit size constant. In our example, this amounts to holding the school size constant, but not the proportion of minorities in each school.

Within the context of our study, we randomly allocate the students in each defined subsample to a school in the municipality. In this allocation process, school size, number of students, and minority proportion in each municipality are held constant. We believe that this better reflects the situation in NRW, where primary schools are essentially not allowed to grow (as the number of classes per grade is fixed), while the composition of students within a school might change. Moreover, restricting the random allocation to the municipality level accounts for the limited mobility of students. This approach allows us to obtain an estimate of segregation resulting from a purely random enrollment process across schools within a municipality, which we label expected segregation (Carrington and Troske, 1997; Cortese, Falk and Cohen, 1976) and which we denote by D_t^*. Note that expected segregation D_t^* will be affected whenever the composition of the population changes. For instance, the new nationality law, the new cutoff date for enrollment and the demographic change affect either the proportion of minorities in the municipality or the population of first graders, thus also

affecting expected segregation. However, expected segregation remains constant with respect to the existence of school districts, as neither group size nor the proportion of minorities is changed.

We calculate Wald statistics to test for significant differences between observed $D_{t=1}$ and $D_{t=2}$. Clearly, however, since observed segregation is also affected by the nationality law, the new cutoff date for enrollment and the demographic change, simply comparing observed segregation before and after the abolition of school districts does not yield the causal effect of school districts on segregation. Therefore, we need to control for changes in the group sizes that will be reflected in the random allocation of the students. The resulting adjusted or systematic segregation index $\hat{D}_t$ is given by

$$\hat{D}_t = D_t - D_t^*, \tag{3}$$

where $\hat{D}_t$ is the extent to which the sample is more dissimilar than it would be using purely random enrollment procedures. Applied to the question of school segregation, we can interpret the difference between observed segregation and the expected level of segregation as the result of residential segregation (even with binding catchment areas, residential segregation is reflected in school segregation) and, of course, parental choice.

Finally, we test for changes in systematic segregation over time. Since $\hat{D}_t$ is a linear combination of two i.i.d. variables – $\hat{D}_t = D_t - D_t^*$ – with $E(\hat{D}_t) = E(D_t) - E(D_t^*)$, we get $\hat{V}(\hat{D}_t) = \hat{V}(D_t) + \hat{V}(D_t^*)$. Hence, under H_0 the Wald statistic is given by

$$W = \frac{\left(\hat{D}_1 - \hat{D}_2\right)^2}{\hat{V}(\hat{D}_1) + \hat{V}(\hat{D}_2)}. \tag{4}$$

So far, we have not discussed the appropriate level – state or municipality – at which segregation should be measured. We first look at state-wide segregation and address changes over time due to policy changes. However, issues of segregation might differ across a heterogeneous federal state like NRW, with urban areas that are characterized by ethnic diversity and socio-economic disparities on the one hand and rural areas that are more homogeneous with respect to ethnicity and socio-economic conditions on the other hand. Furthermore, the municipalities are the more appropriate subjects of the analysis, since the municipalities are the school authorities and decide on the design of the school districts as well as the location and the closure of schools. Because levels of

systematic segregation might differ between municipalities, we estimate a random effects model to explain differences in segregation in terms the characteristics of the municipality, namely

$$\hat{D}_{mt} = \alpha + x'_{mt}\beta + \gamma A + \nu_m + \varepsilon_{mt}, \qquad (5)$$

where $\hat{D}_{mt}$ is the systematic segregation in municipality *m* at time *t*, x'_{mt} is the vector of control variables, *A* is a dummy variable indicating whether the municipality abolished school districts, ν_m represents the random effects, and ε_{mt} is the i.i.d. error term. For the random effects model, ν_m must be uncorrelated with x_{mt}. A Hausman specification test will be performed to test the assumption.

5. The Results

a. School Segregation in NRW

First, we calculate the segregation indices for primary schools in NRW. In 2006/07, the subsample of municipalities which abolished school districts early consists of 15 municipalities with 254 schools (see Table 2, column (j)) and about 13,000 students. The remaining 381 municipalities in the second subsample abolished school districts in 2008/09 and comprise more than 3,100 schools with about 170,000 students in 2006/07. Hence, with the first subsample (early abolition) we can analyze segregation one year before and two years after the reform. For the second subsample (regular abolition), segregation is analyzed two years before and one year after the reform.

The (observed) segregation measures D_t for the three minority groups (Turkish, non-German, and Muslim students) are summarized in Table 2.

(Table 2 about here)

For all groups and both subsamples we observe a moderate increase in segregation over time. Looking at the subsample with early abolition first, segregation between Turkish and non-Turkish students increases from .5976 in 2006/07 to .6398 in 2007/08 and to .6362 in 2008/09 (Table 2, column (a)). The change in segregation is significant at the 5% level for the first two years and insignificant in the third year. At first glance, then, the abolition of school districts causes a significant increase in segregation in 2007/08. However, the same effect is also observed for the second subsample of municipalities to

an even slightly greater degree. Segregation increases significantly from 2006/07 to 2007/08 (when school districts still existed) and from 2006/07 to 2008/09, after school districts were abolished. Thus, it is far from clear whether abolishing school districts in fact resulted in greater segregation.

The segregation indices for students with non-German citizenship are smaller than for the Turkish students. However, the change in segregation from 2006/07 to 2008/09 is of similar magnitude (Table 2, column (d)), though on a different level of significance. Moreover, recall that the effects of the decreasing minority proportion and the larger number of enrollments in 2007/08 are reflected in D_t as well. Surprisingly, the segregation indices by denomination (Muslim or non-Muslim) differ from the results described above (Table 2, columns (g) to (i)). In both subsamples, segregation first increases moderately from 2006/07 to 2007/08, and then decreases in 2008/09. However, none of these changes are significant at the 10% level.

Clearly, the results obtained so far are purely descriptive and cannot be interpreted as causal effects. Even if segregation increases over time, it is not apparent whether the change is caused by abolishing school districts, or if this variation over time is due to other policy changes, like the amendment of the nationality law or the new cutoff date for enrollment. Note that all three policy changes potentially affect the segregation index. The new nationality law and the changed cutoff date affect student composition and the size of the first-grade population. These effects should be primarily captured by the expected level of segregation. On the other hand, abolishing school districts affects parents' school choice behavior, but not the composition of students or group sizes. Hence, abolishing school districts will leave the expected level of segregation unchanged.

To control for the changing composition and size of the first-graders cohort, we calculate the expected segregation index with a random allocation of students as described in Section 3 and use it to compute the index of systematic segregation. The results are summarized in Table 3.

(Table 3 about here)

Columns (a), (d) and (g) report the observed segregation indices as discussed above, and column (b) shows the expected segregation indices using random allocation for Turkish

students and for each school year. While the number and proportion of Turkish students decrease over time, the expected segregation index increases. This is a well-known characteristic of the segregation measure *D*, which increases with smaller minority populations. Hence, we calculate the systematic segregation index $\hat{D}_t$ as described in (3) to control for changes in the random segregation. If the abolition of school districts has an effect on systematic segregation, we expect systematic segregation to increase significantly in 2007/08 for the smaller subsample and in 2008/09 for the larger subsample.

The adjusted dissimilarity index $\hat{D}_t$ for Turkish versus non-Turkish students in the small subsample is substantially smaller than the unadjusted index D_t, and the changes over time are no longer significant at the 5% level. The decrease in systematic segregation from 2007/08 to 2008/09 is more pronounced than for observed segregation, but is also not significant. The results for segregation based on non-German citizenship and Muslim denomination are quite similar; however, systematic segregation in 2008/09 is even smaller than in 2006/07 for all groups.

Segregation in municipalities that abolished their school districts in 2008/09 is summarized in the lower part of Table 3. Despite the increase in school choice, the index of systematic segregation does not increase significantly from 2007/08 to 2008/09, neither for Turkish and non-Turkish students nor for non-German and German students. The increase in systematic segregation from 2006/07 to 2007/08 for Turkish and non-German students is significant, but cannot be caused by the admission reform at all. Hence, the index of systematic segregation, $\hat{D}_t$, does not support the hypothesis that segregation significantly increases with the absence of school districts.

b. School Segregation at the Municipality Level

As Figure 4 shows, there is substantial ethnic and economic heterogeneity between municipalities in NRW. Hence, it might be more appropriate to calculate segregation indices and compare measures of segregation for each of the 396 municipalities. This also allows us to describe differences in systematic segregation between municipalities and to explain regional differences.

(Figure 4 about here)

Figure 5 illustrates changes in systematic segregation between Turkish and non-Turkish students within the municipalities. Municipalities with only one primary school or no students of the minority group are excluded from the analysis. Each vertical line shows the p-values (multiplied by the direction of change) for changes in systematic segregation for one municipality and one year. For example if segregation increases from 2006/07 to 2007/08, we get a positive value, while the value is negative if segregation decreases. The grey area marks the significance level of 5%. In addition, whenever the change is significant at the 10% level, the line is marked with a symbol, with a dot indicating increasing segregation and a cross indicating decreasing segregation. As Figure 5 shows, there appears to be no common trend. Some municipalities experience increasing segregation, while others experience decreasing segregation. For example, segregation in 2007/08 increases significantly for 14 municipalities and decreases for another 14 municipalities. Moreover, while there are more instances of increasing segregation from 2006/07 to 2007/08, most of them are insignificant.

In Figure 6(a) each row represents a municipality with at least one significant change (at the 5% level) in systematic segregation in 2007/08 or 2008/09. Municipalities without at least one significant change are not reported. If segregation increases from 2006/07 to 2007/08, the change is marked with a square; if this change is significant, the square is solid black. A significant decrease in segregation is represented by a solid black triangle, while insignificant decrease in segregation is represented by a hollow grey triangle. The municipalities that abolished school districts in 2007/08 are highlighted grey. The results for non-German vs. German and Muslim vs. non-Muslim segregation are quite similar (see Figure 6 (b) - (c)).

Figure 6 shows that there is no common trend in segregation in the municipalities; segregation is neither increasing nor decreasing. Moreover, segregation does not seem to change systematically in NRW. Only few municipalities exhibit with a permanent positive or negative (significant) segregation trend, indicated by a either two solid black squares or two solid black triangles. Segregation between Turkish and non-Turkish students significantly increases twice in only one municipality. At the same time, segregation decreases significantly in only one municipality as well. All other municipalities show no significant trend. On the whole, the inconclusive results of the earlier analysis are confirmed.

Since some of the municipalities in NRW are rather small and have small minority proportions and a small number of schools, the segregation indices and in particular their significance levels have to be interpreted with caution. Hence, we restrict the sample to the 20 largest municipalities in NRW in 2006, which have at least an appropriate number of schools. We rank the municipalities according to the systematic segregation measure $\hat{D}_t$ in 2006/07 and check whether their ranking position changes in 2007/08 or 2008/09. The results are summarized in Tables 4, 5, and 6.

(Tables 4, 5, and 6 about here)

Looking at systematic segregation in the 20 largest cities in NRW, the range is surprisingly large. While the systematic segregation index between Turkish and non-Turkish students is only .065 in Solingen, it reaches a value of .416 in Krefeld in 2006/07. However, there are only few significant changes in segregation and the ranking of municipalities over time. The largest change in the ranking (-6) is reported for Herne (a *smaller* city in NRW) in 2007/08; however segregation in this city decreases again one year later. Bielefeld goes down by 4 ranks in 2007/08, only to go up by 4 ranks the following year. Hence, levels of segregation differ between the municipalities, but policy changes appear not to matter. In Tables 5 and 6, we report the results for segregation between German and non-German students and Muslim and non-Muslim students, respectively. As expected, the results are similar and also inconclusive.

In the final step of the analysis we estimate a random effects model to explain systematic segregation. Municipalities which have only one school or no minority students are excluded from the regressions. To explain systematic segregation, we use additional data. To control for the year of school district abolition, we define a dummy variable with the value of 1 if school districts were abolished and 0 otherwise. Hence, the variable is equal to 1 only for the year in which school districts were abolished. Moreover, we include year dummies to account for a time trend in segregation. Since denominational schools tend to increase choice options, regardless of the presence or absence of school districts, we define dummy variables that are equal to 1 if the municipality has no denominational school, no public school or, alternatively, both school types.

Since segregation might be affected by group sizes, we also control for the proportion of minority students and the squared proportion to allow for a non-linear relationship. The new cutoff date is taken into account by adding the log of the total number of enrollments to the model. To account for the number of alternative schools, a school competition variable is generated. For each public primary school in each municipality and each *t* we determine the number of public schools within a radius of 2 km (Euclidian distance) around the school and calculate the average number of neighboring schools for the municipality. A value of 6.2, for instance, indicates that each school in the municipality has to compete with 6 other schools on average. Of course, in smaller and rural municipalities, this measure of competition can be zero or close to zero. The average for all municipalities is 1.65, with a standard deviation of 1.6, a minimum of 0 competing schools, and a maximum of 7.89 competing schools.

In the following we report the results of these random effect models. The Hausman test does not reject the random effects specification in either case. The results are summarized in Tables 7, 8, and 9 for each minority group.

(Tables 7, 8, and 9 about here)

The dependent variable in Table 7 is systematic segregation between Turkish and non-Turkish students. In model (1) only the time variables and the dummy for abolition of school districts are included. The abolition variable is significant, and there is also a significant increase in segregation in 2007. But note that the R^2s are close to zero. Hence, in model (2) we also include the proportion of Turkish students and the squared proportion of Turkish students. As expected, systematic segregation increases with a higher percentage of minority students, but at a decreasing rate. In municipalities that have only one type of elementary school (public or denominational), segregation is lower, indicating that less choice reduces segregation. The R^2-within and the R^2-between increase to .12 and .47, respectively. Note that the abolition variable is no longer significant in (2). Controlling for the size of the municipality is done by including the number of first graders, which turns out to be significant. Larger municipalities have substantially higher levels of systematic segregation. Since the larger municipalities typically also have both elementary school types, it is not surprising that having both school types is no longer significant once we control for size. Hence, model (4)

excludes the school type variable, which leaves the remaining coefficients basically unchanged. Finally, since competition between schools might increase segregation because it allows for more choice, we also include the average number of schools within 2 km² in the model. It turns out that competition increases systematic segregation; only if alternative schools are available and closeby do parents have a chance to choose. Hence, choice does, in fact, increase segregation. Note that model (7) explains 52% of the variation between municipalities and 12% of the variation within municipalities. Adding other variables that describe the municipality, such as unemployment rate, percentage of immigrants or percentage of one-family and two-family houses, does not improve the model fit and turns out to be insignificant.

Before turning our attention to the other two minority groups, we would like to comment on the significant impact of the year 2007 in Table 7. Recall that two policy changes in 2007 potentially affected segregation: The amendment of the nationality law and the new cutoff date for enrollment. The amendment of the nationality law leaves the size of the population constant, but changes the proportion of minorities. Consequently, there are less Turkish students in the first grade. This is assumed to increase expected segregation but leave systematic segregation unchanged, as long as the characteristics of the minority group do not change. However, this is unlikely to be the case. German citizenship is not granted to all children with Turkish parents, but only to those children with at least one parent who has been living in Germany for at least 8 years and who has a permanent right of residence. Moreover, the citizenship variable is reported by parents when the child is registered at school; this information is not verified with other official data. Hence, the remaining Turkish children are not likely to be a random sample of the Turkish population before the change in the nationality law; thus, we expect systematic segregation to increase. Changing the cutoff date for enrollment, on the other hand, increases the group size but will leave the minority proportion constant. This tends to decrease expected segregation. But with a larger number of students, competition for good schools becomes stronger, and parental choice is likely to increase systematic segregation. Therefore, both 2007 policy changes will rather tend to increase systematic segregation than to decrease it.

Table 8 summarizes the results for systematic segregation between non-German and German students. The results are similar to Table 7, though there are some differences as well. The time trend and the abolition variable are not significant,

regardless of the model specification. Only in 2007 does systematic segregation increase significantly in specifications (2) and (5). The proportion on non-German students has a positive and significant effect, but the effect is much smaller than for the proportion of Turkish students. The size of the effect, however, is similar. Larger municipalities have higher levels of segregation. The competition variable is also significant, but somewhat smaller than in Table 7. With an R^2-within of 8%, and an R^2-between of up to 50%, the model fit is slightly worse but still acceptable. However, since the non-German population is more heterogeneous then the Turkish population, this is to be expected.

Segregation with respect to denomination is analyzed in Table 9. Overall, the models explain the variation in systematic segregation less well that in Tables 7 and 8. Segregation between Muslims and non-Muslims does not change over time, and abolishing school districts is also insignificant. The signs of the coefficients, however, are all negative, indicating that segregation might have slightly decreased over time. While a higher proportion of Muslims in the municipality increases segregation, the effect is even smaller than for segregation between non-German and German students. However, having both types of schools significantly increases segregation in (2) and (3). This is expected, as denominational schools – most of which are Catholic – might not be a choice option for Muslim families. Hence, they are predominantly chosen by non-Muslims, thereby increasing segregation. The size effect is similar to the corresponding effects in Tables 7 and 8, but the competition effect is stronger than in the other models.

6. Conclusion

NRW, the most populous German federal state, abolished primary school districts in 2008. Critics argued that ethnic segregation might increase if parents are allowed to freely choose a primary school. Given that socio-economic background already explains academic achievement in Germany to a larger extent than in other countries, an increase in school segregation is not desirable. However, little is known is about school choice in Germany in general and the effect of abolishing school districts in particular.

In this paper, we used data from the school years 2006/07 to 2008/09 on all municipalities in NRW to analyze changes in segregation over time and between municipalities. The well-known drawbacks of the commonly-used segregation indices

in small samples have been addressed in the literature, and methods to compare dissimilarity indices have been proposed. We contribute to this literature by using an adjusted segregation index that is corrected for random segregation. The data allows segregation between Turkish and non-Turkish students, non-German and German students, and also Muslim and non-Muslim students to be analyzed. We proceed in two steps. First the analysis is done on the federal state level. While segregation does in fact change over time, the changes cannot be attributed to the existence of school districts. The change in the nationality law and the changing cutoff date better explain changes in segregation. Clearly, however, in a heterogeneous state like NRW, the state-wide level of segregation might not be the only measure of interest. Hence, we also looked at the municipality level. Segregation varies substantially between municipalities and also over time within the municipalities. While some municipalities experience a significant increase in segregation, others experience a significant decrease. There appears to be no common trend. Even if the sample is reduced to the more homogeneous group of large cities in NRW, a common trend is unverifiable. Finally, in a random effects specification, we explain systematic segregation. It turns out that school districts appear not to matter. However, the ethnic student composition and the degree of school competition or available alternatives do significantly explain segregation.

As noted earlier, the new government has reintroduced school districts on a voluntary basis in 2010. So far, municipalities have hesitated to exercise that option, and our analysis provides an explanation for this reluctance: school districts do not reduce or enhance, and therefore do not explain school segregation in NRW. It is quite possible that school choice played a significant role even in the presence of school districts. In addition, residential segregation leads to school segregation that exceeds the level of expected segregation. And finally, our data set only comprises the first year after school districts were abolished. It might take more time for parents to learn how to practice school choice. At any rate, the data for 2009/10 and 2010/11 will soon become available, enabling us to expand upon this analysis.

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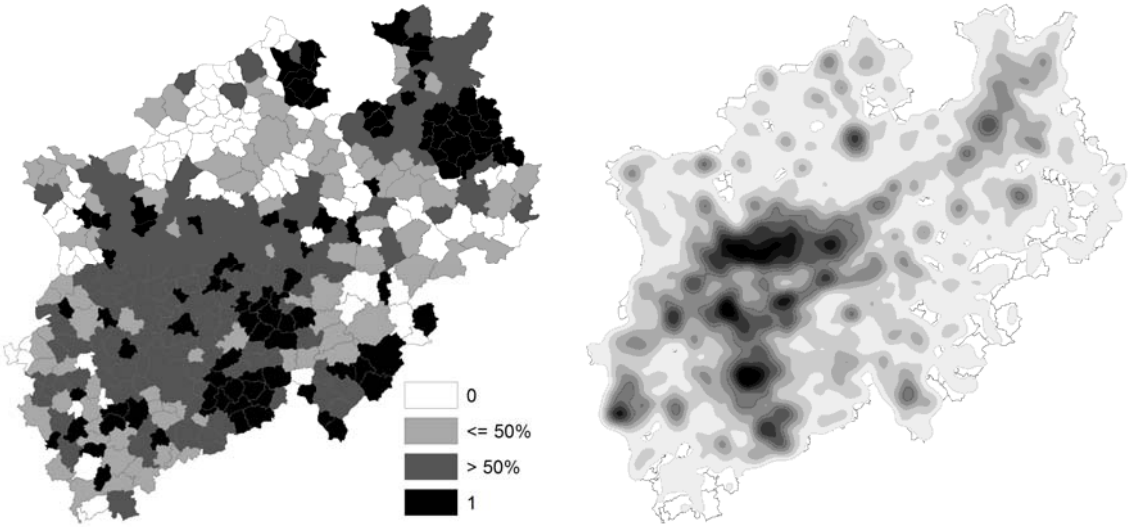
Table 1. *Sample Description*

	All schools			Schools with 1st grade		
School year	2006/07	2007/08	2008/09	2006/07	2007/08	2008/09
All primary schools	3,421	3,368	3,266	3,400	3,355	3,249
Public schools	2,196	2,167	2,111	2,185	2,161	2,104
Catholic schools	1,102	1,076	1,031	1,093	1,070	1,023
Protestant schools	94	92	86	93	91	84
	All grades			1st grade		
Students in primary schools	737,455	715,932	689,687	174,310	175,615	161,783
non-German	110,339	100,985	89,615	23,711	20,925	18,028
% non-German	*14.9*	*14.1*	*13.0*	*13.6*	*11.9*	*11.1*
Turkish	57,354	50,604	42,218	11,457	9,509	7,448
% Turkish	*7.8*	*7.1*	*6.1*	*6.6*	*5.4*	*4.6*
Muslim	100,769	100,536	99,036	24,758	25,907	23,967
% Muslim	*13.7*	*14.0*	*14.4*	*14.2*	*14.8*	*14.8*

Figure 1. *Public and denominational schools and school density in NRW*



(a) Percentage of public schools, 2008/09 (b) School density, primary schools

Figure 2. *Total number of births in North Rhine-Westphalia from 1990 to 2008*

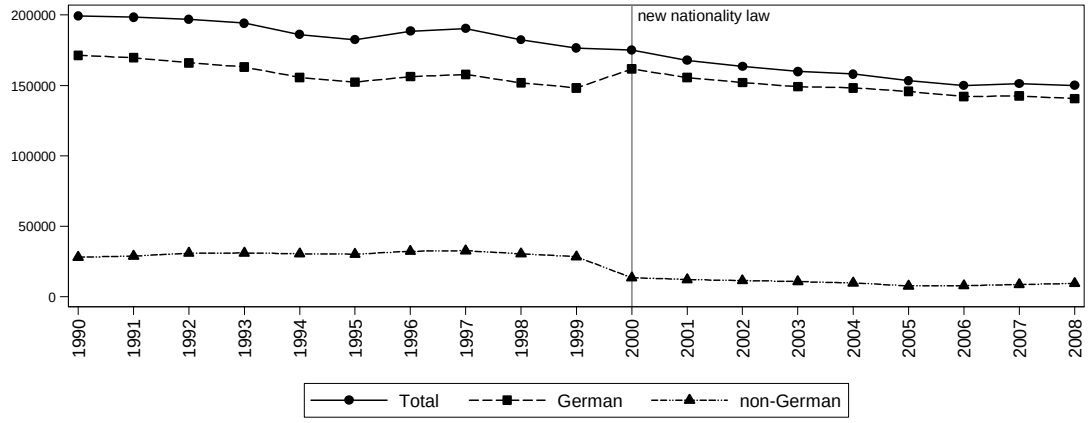


Figure 3. *Enrollments in North Rhine-Westphalia from school year 1999/00 to 2008/09*

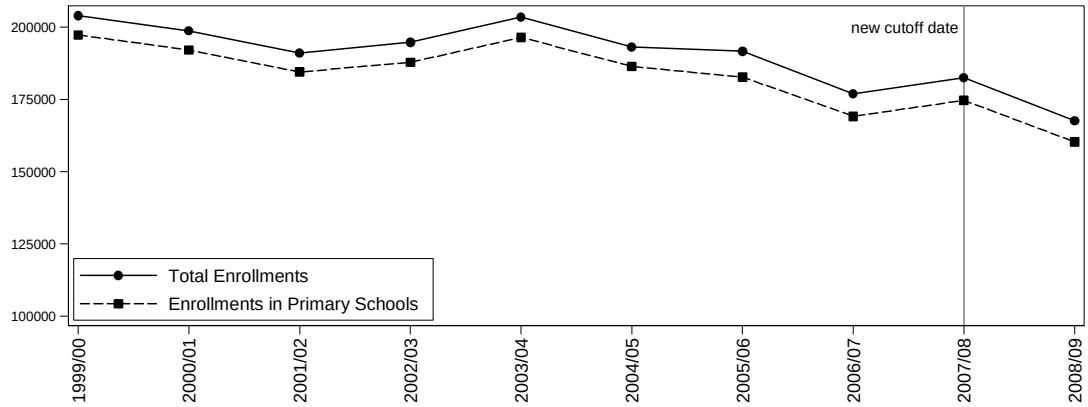
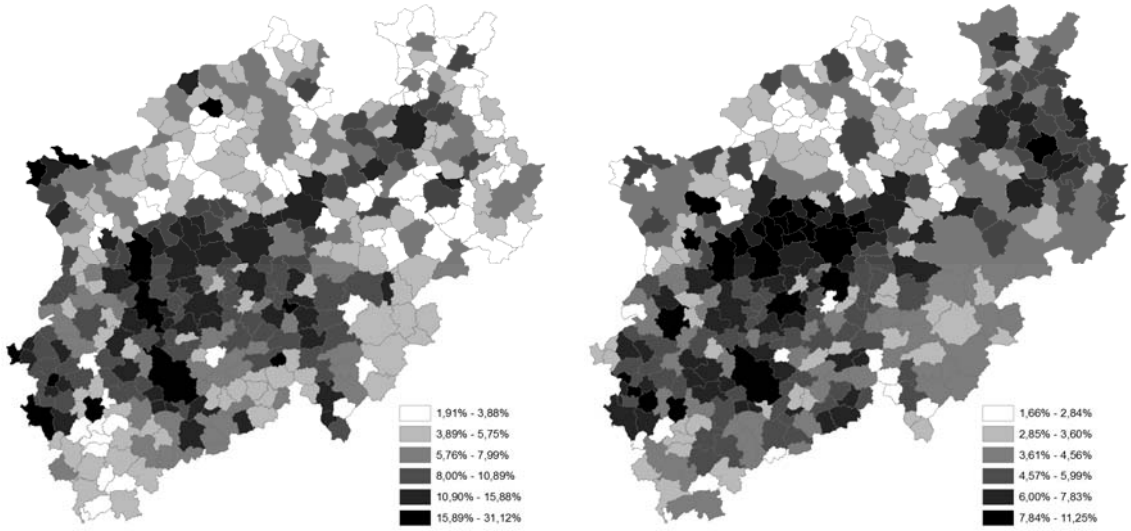


Figure 4. *Non-German population and unemployment rate in NRW in 2008*



(a) Percentage of non-German population (b) Unemployment rate

Note: The unemployment rate reported here is defined as the total number of unemployed related to the population aged 15 to 65 years.

Table 2. *Observed Segregation in NRW's primary schools*

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
	D_t Turkish students	n_{1t} Turkish students	n_{0t} non-Turkish students	D_t non-German students	n_{1t} non-German students	n_{0t} German students	D_t Muslim students	n_{1t} Muslim students	n_{0t} non-Muslim students	J_t Number of schools
Abolition of school districts in 2007/08 (15 municipalities)										
Grade 1 2006/07	**0.5976**			**0.4640**			**0.4840**			
H_0: $D_{2006/07} = D_{2007/08}$	*4.9515*			*4.7247*			1.1094			
	(0.0261)	948	11,930	*(0.0297)*	2,144	10,734	(0.2922)	2,313	10,565	254
H_0: $D_{2006/07} = D_{2008/09}$	*3.4905*			0.2001			0.1180			
	(0.0617)			(0.6547)			(0.7312)			
Grade 1 2007/08	**0.6398**			**0.4965**			**0.4983**			
H_0: $D_{2007/08} = D_{2008/09}$	0.0260	692	12,427	2.4200	1,775	11,344	0.4790	2,308	10,811	248
	(0.8719)			(0.1198)			(0.4889)			
Grade 1 2008/09	**0.6362**	516	11,730	**0.4710**	1,523	10,723	**0.4888**	2,209	10,037	243
Abolition of school districts in 2008/09 (381 municipalities)										
Grade 1 2006/07	**0.5516**			**0.4708**			**0.4895**			
H_0: $D_{2006/07} = D_{2007/08}$	*119.8004*			*49.1231*			0.7522			
	(0.0000)	10,509	150,923	*(0.0000)*	21,567	139,865	(0.3858)	22,445	138,987	3,117
H_0: $D_{2006/07} = D_{2008/09}$	*156.8862*			*93.5455*			0.1710			
	(0.0000)			*(0.0000)*			(0.6792)			
Grade 1 2007/08	**0.6126**			**0.5032**			**0.4932**			
H_0: $D_{2007/08} = D_{2008/09}$	*4.6289*	8,817	153,679	*7.9077*	19,150	143,346	1.6185	23,599	138,897	3,054
	(0.0314)			*(0.0049)*			(0.2033)			
Grade 1 2008/09	**0.6255**	6,932	142,605	**0.5168**	16,505	133,032	**0.4877**	21,758	127,779	2,942

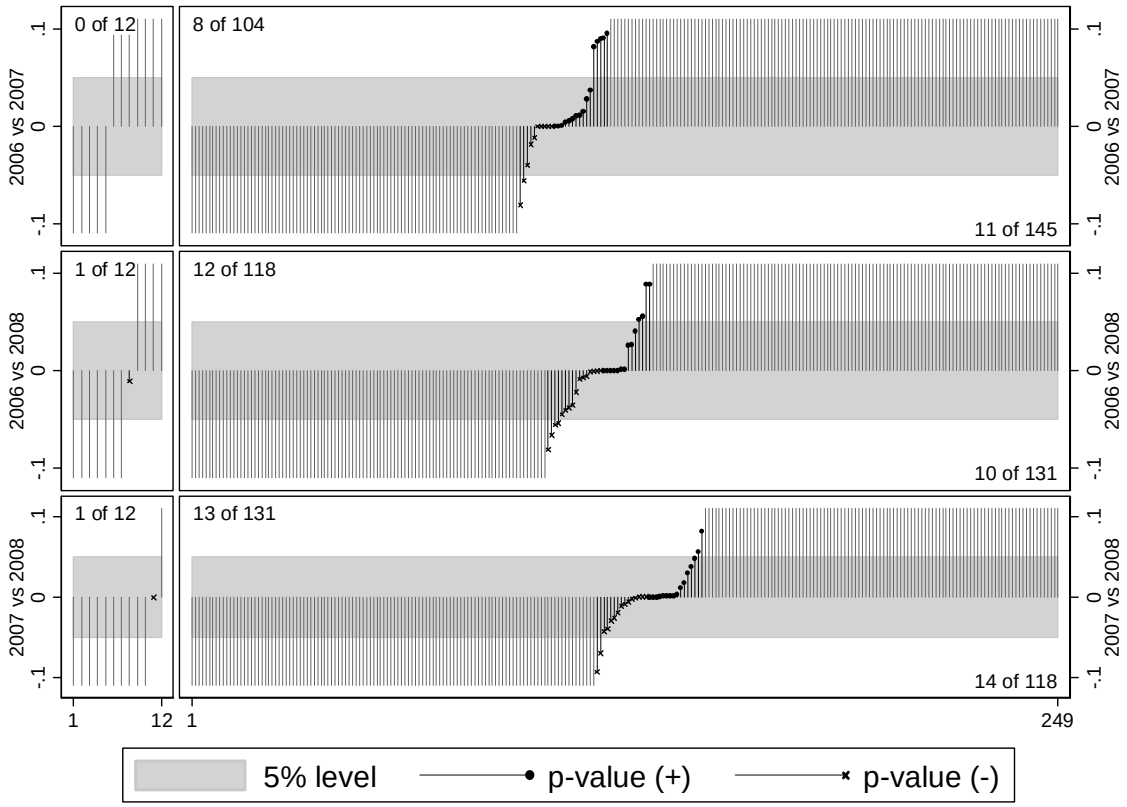
Note: The reported figures are observed segregation indices; p-values of the Wald-test on equality of the segregation indices in parentheses; *D*s are printed bold, significant values in italics.

Table 3. *Observed segregation, expected segregation using random allocation and systematic segregation in NRW*

	(a)	(b)	(c)	(d)	(e)	(f)	(g)	(h)	(i)	(j)
	D_t Turkish students	D_t^* Turkish students	$\hat{D}_t$ Turkish students	D_t non-German students	D_t^* non-German students	$\hat{D}_t$ non-German students	D_t Muslim students	D_t^* Muslim students	$\hat{D}_t$ Muslim students	J_t Number of schools
Abolition of school districts in 2007/08 (15 municipalities)										
Grade 1 2006/07	**0.5976**	**0.4179**	**0.1797**	**0.4640**	**0.2548**	**0.2092**	**0.4840**	**0.2407**	**0.2433**	
H_0: $D_{2006/07} = D_{2007/08}$	*4.9515*		0.1562	*4.7247*		0.3307	1.1094		0.0967	
	(0.0261)		(0.6927)	*(0.0297)*		(0.5653)	(0.2922)		(0.7558)	254
H_0: $D_{2006/07} = D_{2008/09}$	*3.4905*		0.6316	0.2001		0.8050	0.1180		0.0078	
	(0.0617)		(0.4268)	(0.6547)		(0.3696)	(0.7312)		(0.9295)	
Grade 1 2007/08	**0.6398**	**0.4488**	**0.1910**	**0.4965**	**0.2745**	**0.2220**	**0.4983**	**0.2488**	**0.2495**	
H_0: $D_{2007/08} = D_{2008/09}$	0.0260		1.1821	2.4200		1.9282	0.4790		0.1582	248
	(0.8719)		(0.2769)	(0.1198)		(0.1650)	(0.4889)		(0.6909)	
Grade 1 2008/09	**0.6362**	**0.4806**	**0.1556**	**0.4710**	**0.2826**	**0.1884**	**0.4888**	**0.2473**	**0.2415**	243
Abolition of school districts in 2008/09 (381 municipalities)										
Grade 1 2006/07	**0.5516**	**0.3990**	**0.1526**	**0.4708**	**0.3142**	**0.1566**	**0.4895**	**0.3361**	**0.1534**	
H_0: $D_{2006/07} = D_{2007/08}$	*119.8004*		*7.2645*	*49.1231*		*6.5917*	0.7522		0.3414	
	(0.0000)		*(0.0070)*	*(0.0000)*		*(0.0102)*	(0.3858)		(0.5590)	3,117
H_0: $D_{2006/07} = D_{2008/09}$	*156.8862*		*7.4698*	*93.5455*		*10.4504*	0.1710		0.2277	
	(0.0000)		*(0.0063)*	*(0.0000)*		*(0.0012*)	(0.6792)		(0.6332)	
Grade 1 2007/08	**0.6126**	**0.4376**	**0.1750**	**0.5032**	**0.3295**	**0.1737**	**0.4932**	**0.3434**	**0.1498**	
H_0: $D_{2007/08} = D_{2008/09}$	*4.6289*		0.0318	*7.9077*		0.5304	1.6185		0.0093	3,054
	(0.0314)		(0.8584)	*(0.0049)*		(0.4664)	(0.2033)		(0.9233)	
Grade 1 2008/09	**0.6255**	**0.4489**	**0.1766**	**0.5168**	**0.3380**	**0.1788**	**0.4877**	**0.3373**	**0.1504**	2,942

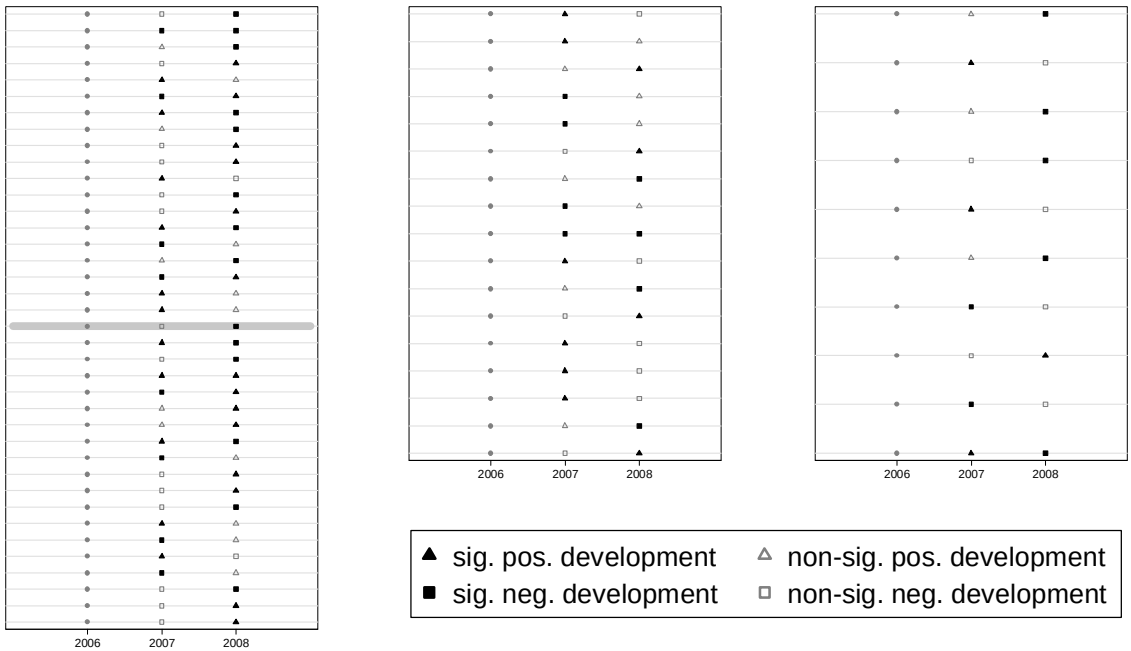
Note: The reported figures for D^* are means from 100 random samples of allocation and 100 random samples for the double bootstrap calculation of the variance; p-values of the Wald-test on equality of the segregation indices in parentheses; *D*s are printed bold, significant values in italics.

Figure 5. *Changes in systematic segregation - Turkish vs. non-Turkish students*



Note: The direction indicates whether segregation increases (+) or decreases (-); number of significant negative (positive) changes in the upper (lower) corner; municipalities which abolished their school districts in 2007/08 are on the left hand side.

Figure 6. *Systematic segregation in municipalities with significant changes in segregation*



(a) Turkish vs. non-Turkish (b) non-German vs. German (c) Muslim vs. non-Muslim

Table 4. *Ranking of systematic segregation for the largest 20 municipalities, Turkish vs. non-Turkish students*

Municipality	population in 2006	percentage of non-German population in 2006	systematic segregation $\hat{D}_t$ and rank 2006/07	2007/08	2008/09
Abolition of school districts in 2007/08					
Düsseldorf	577,505	17.94	0.2316 (1)	0.2367 (1)	0.1365 (1)
Hagen	195,671	13.20	0.3244 (2)	0.3771 (2)	0.3461 (2)
Hamm	183,672	13.56	0.3655 (3)	0.4139 (3)	0.4128 (3)
Abolition of school districts in 2008/09					
Solingen	162,948	13.29	0.0650 (1)	0.0888 (1)	0.1255 (2)
Münster	272,106	7.19	0.1453 (2)	0.0931 (2)	0.0038 (1)*
Bonn	314,299	16.25	0.1583 (3)	0.2032 (3)	0.2171 (3)
Herne	169,991	15.03	0.2252 (4)	0.3286 (10)	0.3239 (9)
Wuppertal	358,330	15.51	0.2384 (5)	0.2388 (5)	0.2376 (4)
Gelsenkirchen	266,772	13.68	0.2533 (6)	0.2951 (8)	0.3423 (12)
Aachen	258,770	17.13	0.2541 (7)	0.2205 (4)	0.2871 (6)
Bielefeld	325,846	12.04	0.2580 (8)	0.3755 (12)*	0.2991 (8)
Bochum	383,743	11.38	0.2613 (9)	0.2711 (6)	0.2926 (7)
Mönchengladbach	260,951	10.73	0.2650 (10)	0.3273 (9)	0.3272 (10)
Köln	989,766	16.90	0.2786 (11)	0.4245 (16)***	0.3908 (14)
Essen	583,198	11.85	0.2924 (12)	0.2939 (7)	0.2817 (5)
Oberhausen	218,181	12.85	0.3007 (13)	0.3657 (11)	0.3417 (11)
Mülheim an der Ruhr	169,414	9.94	0.3233 (14)	0.3900 (14)	0.4463 (16)
Dortmund	587,624	15.86	0.3629 (15)	0.3929 (15)	0.3821 (13)
Duisburg	499,111	16.50	0.3639 (16)	0.3894 (13)	0.4161 (15)
Krefeld	237,104	12.89	0.4162 (17)	0.4754 (17)	0.4578 (17)

Note: The reported municipalities are the 20 largest in NRW (population density in 2006); municipalities are ordered with respect to their rank in 2006/07;
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5. *Ranking of systematic segregation for the largest 20 municipalities, non-German vs. German students*

Municipality	population in 2006	percentage of non-German population in 2006	systematic segregation $\hat{D}_t$ and rank 2006/07	2007/08	2008/09
Abolition of school districts in 2007/08					
Düsseldorf	577,505	17.94	0.2566 (1)	0.2592 (1)	0.2126 (1)
Hamm	183,672	13.56	0.3251 (2)	0.3494 (2)	0.3525 (3)
Hagen	195,671	13.20	0.3392 (3)	0.3404 (3)	0.3307 (2)
Abolition of school districts in 2008/09					
Solingen	162,948	13.29	0.1691 (1)	0.2080 (2)	0.2214 (3)
Herne	169,991	15.03	0.2091 (2)	0.2648 (5)	0.3169 (8)
Bonn	314,299	16.25	0.2349 (3)	0.2092 (3)	0.2155 (2)
Wuppertal	358,330	15.51	0.2490 (4)	0.2457 (4)	0.2340 (4)
Münster	272,106	7.19	0.2509 (5)	0.1961 (1)	0.2152 (1)
Bielefeld	325,846	12.04	0.2769 (6)	0.3535 (11)	0.2988 (7)
Bochum	383,743	11.38	0.2831 (7)	0.2976 (6)	0.2862 (6)
Köln	989,766	16.90	0.2968 (8)	0.3651 (12)**	0.3515 (11)
Gelsenkirchen	266,772	13.68	0.3133 (9)	0.3494 (10)	0.3248 (9)
Oberhausen	218,181	12.85	0.3218 (10)	0.3454 (8)	0.3447 (10)
Aachen	258,770	17.13	0.3260 (11)	0.3231 (7)	0.2667 (5)
Krefeld	237,104	12.89	0.3288 (12)	0.4038 (15)	0.3613 (12)
Mönchengladbach	260,951	10.73	0.3295 (13)	0.4094 (17)	0.3862 (13)
Mülheim an der Ruhr	169,414	9.94	0.3492 (14)	0.3883 (13)	0.4332 (17)
Duisburg	499,111	16.50	0.3702 (15)	0.3941 (14)	0.4206 (16)
Essen	583,198	11.85	0.3771 (16)	0.3472 (9)	0.4074 (15)
Dortmund	587,624	15.86	0.3885 (17)	0.4081 (16)	0.4016 (14)

Note: see Table 4

Table 6. *Ranking of systematic segregation for the largest 20 municipalities, Muslim vs. non-Muslim students*

Municipality	population in 2006	percentage of non-German population in 2006	systematic segregation $\hat{D}_t$ and rank 2006/07	2007/08	2008/09
Abolition of school districts in 2007/08					
Düsseldorf	577,505	17.94	0.2990 (1)	0.3181 (1)	0.3137 (2)
Hamm	183,672	13.56	0.3167 (2)	0.3518 (3)	0.3165 (3)
Hagen	195,671	13.20	0.3603 (3)	0.3291 (2)	0.2980 (1)
Abolition of school districts in 2008/09					
Solingen	162,948	13.29	0.1704 (1)	0.1802 (2)	0.2085 (4)
Münster	272,106	7.19	0.1913 (2)	0.1769 (1)	0.1764 (1)
Herne	169,991	15.03	0.2053 (3)	0.2065 (3)	0.2519 (6)
Bielefeld	325,846	12.04	0.2132 (4)	0.2624 (6)	0.2043 (3)
Oberhausen	218,181	12.85	0.2166 (5)	0.2205 (4)	0.2035 (2)
Mönchengladbach	260,951	10.73	0.2592 (6)	0.3115 (11)	0.2374 (5)
Aachen	258,770	17.13	0.2606 (7)	0.2795 (8)	0.2637 (7)
Wuppertal	358,330	15.51	0.2630 (8)	0.2332 (5)	0.2916 (10)
Bonn	314,299	16.25	0.2669 (9)	0.3266 (13)	0.2798 (9)
Köln	989,766	16.90	0.2710 (10)	0.2844 (9)	0.2939 (11)
Bochum	383,743	11.38	0.2716 (11)	0.2676 (7)	0.2735 (8)
Gelsenkirchen	266,772	13.68	0.2926 (12)	0.2982 (10)	0.3201 (14)
Mülheim an der Ruhr	169,414	9.94	0.3346 (13)	0.3257 (12)	0.3086 (13)
Krefeld	237,104	12.89	0.3391 (14)	0.3420 (14)	0.2986 (12)
Duisburg	499,111	16.50	0.3417 (15)	0.3627 (15)	0.3477 (15)
Dortmund	587,624	15.86	0.4031 (16)	0.3913 (16)	0.3822 (16)
Essen	583,198	11.85	0.4111 (17)	0.3945 (17)	0.4242 (17)

Note: see Table 4

Table 7. *Systematic Segregation, Turkish vs. non-Turkish students*

	(1)	(2)	(3)	(4)	(5)
School districts were abolished	0.0309**	0.0202	0.0213	0.0213	0.0214
	(0.0119)	(0.0134)	(0.0129)	(0.0129)	(0.0130)
Year=2007	0.0205*	0.0480***	0.0450***	0.0447***	0.0451***
	(0.0093)	(0.0089)	(0.0090)	(0.0090)	(0.0090)
Year=2008	-0.0246	0.0272	0.0251	0.0249	0.0218
	(0.0143)	(0.0162)	(0.0158)	(0.0157)	(0.0158)
No public & denominational schools		-0.0451***	-0.0180		
		(0.0136)	(0.0144)		
Proportion Turkish students		4.4707***	4.1441***	4.1309***	4.0211***
		(0.4172)	(0.4021)	(0.4036)	(0.4269)
Proportion Turkish students squared		-15.3920***	-14.7483***	-14.7468***	-14.0706***
		(2.7788)	(2.3668)	(2.3692)	(2.6104)
Log(First graders)			0.0406***	0.0448***	
			(0.0080)	(0.0074)	
Average number of schools within 2 km^2					0.0456***
					(0.0079)
Average number of schools within 2 km^2 squared					-0.0044***
					(0.0011)
Constant	0.1508***	0.0045	-0.2309***	-0.2607***	-0.0564***
	(0.0095)	(0.0139)	(0.0468)	(0.0410)	(0.0134)
NT	783	783	783	783	783
N	261	261	261	261	261
Within R^2	0.000	0.123	0.124	0.122	0.122
Between R^2	0.000	0.468	0.515	0.513	0.517

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Random effects models. Robust standard errors in parentheses

Table 8. *Systematic Segregation, German vs. non-German students*

	(1)	(2)	(3)	(4)	(5)
School districts were abolished	0.0224	0.0150	0.0169	0.0168	0.0164
	(0.0165)	(0.0146)	(0.0145)	(0.0145)	(0.0147)
Year=2007	0.0023	0.0207*	0.0162	0.0162	0.0177*
	(0.0083)	(0.0084)	(0.0085)	(0.0085)	(0.0085)
Year=2008	-0.0154	0.0188	0.0150	0.0152	0.0133
	(0.0180)	(0.0164)	(0.0164)	(0.0164)	(0.0166)
Public & denominational schools		0.0408***	0.0147		
		(0.0109)	(0.0112)		
Proportion non-German students		2.3304***	1.9305***	1.9513***	1.9659***
		(0.2224)	(0.2205)	(0.2228)	(0.2412)
Proportion non-German students squared		-4.3959***	-4.0396***	-4.1340***	-3.8623***
		(0.8469)	(0.6838)	(0.6960)	(0.8317)
Log(First graders)			0.0486***	0.0523***	
			(0.0076)	(0.0070)	
Average number of schools within 2 km²					0.0368***
					(0.0072)
Average number of schools within 2 km² squared					-0.0031**
					(0.0011)
Constant	0.1424***	-0.0380**	-0.2679***	-0.2808***	-0.0313*
	(0.0075)	(0.0135)	(0.0350)	(0.0337)	(0.0130)
NT	1056	1056	1056	1056	1056
N	352	352	352	352	352
Within R^2	0.000	0.073	0.074	0.074	0.076
Between R^2	0.000	0.439	0.504	0.501	0.468

Note: see Table 7

Table 9. *Systematic segregation; Muslim vs. non-Muslim students*

	(1)	(2)	(3)	(4)	(5)
School districts were abolished	-0.0026 (0.0162)	-0.0026 (0.0169)	-0.0024 (0.0168)	-0.0025 (0.0169)	-0.0026 (0.0166)
Year=2007	-0.0093 (0.0067)	-0.0097 (0.0067)	-0.0097 (0.0067)	-0.0098 (0.0067)	-0.0089 (0.0067)
Year=2008	-0.0165 (0.0161)	-0.0189 (0.0168)	-0.0147 (0.0167)	-0.0146 (0.0167)	-0.0173 (0.0165)
No denominational school	-0.0691*** (0.0150)			-0.0237 (0.0136)	-0.0200 (0.0134)
No public school	-0.1061*** (0.0182)				
Public & denominational schools		0.0544*** (0.0117)	0.0320** (0.0120)		
Proportion Muslims students		1.4567*** (0.1846)	1.0829*** (0.2169)	1.1200*** (0.2214)	0.9946*** (0.2111)
Proportion Muslims students squared		-2.6056*** (0.5295)	-2.1009*** (0.6097)	-2.1875*** (0.6299)	-1.8088** (0.5560)
Log(First graders)			0.0445*** (0.0081)	0.0482*** (0.0080)	
Average number of schools within 2 km^2					0.0521*** (0.0083)
Average number of schools within 2 km^2 squared					-0.0052*** (0.0012)
Constant	0.1991*** (0.0081)	0.0371** (0.0140)	-0.1763*** (0.0393)	-0.1737*** (0.0418)	0.0476*** (0.0122)
NT	1032	1032	1032	1032	1032
N	344	344	344	344	344
Within R^2	0.019	0.034	0.040	0.038	0.039
Between R^2	0.107	0.314	0.362	0.357	0.373

Note: see Table 7