

The dynamics of socio-economic segregation: What role do private schools play?

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Abstract

Although residential sorting along socio-economic lines has increased in many cities across Europe, few studies have examined what drives changes in segregation over time. This study looks at the role of school choice expansion in shaping patterns of spatial inequality. We adopt a longitudinal perspective and investigate how the increasing availability of private primary schools is related to the dynamics of socio-economic segregation in German cities. Drawing on a uniquely compiled data set for the years 2005 to 2014 that includes 74 large and medium-sized cities with over 3500 districts, we estimate linear panel regression models with city fixed effects. The analyses show that an increase in the share of private primary schools is associated with a decrease in the segregation of poverty in West German cities but not in East German ones. The association in West Germany is particularly pronounced in local contexts characterised by growing rates of poor residents and growing proportions of young children. Results imply that school choice availability may promote residential integration and at the same time reinforce school segregation.

Keywords

education, neighbourhoods, residential segregation, school choice, spatial inequality

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摘要

在欧洲许多城市，社会经济型住宅分类有所增加，但很少有研究关注隔离逐渐发生变化的推动因素。本文探讨了越来越多的择校在形成空间不平等模式中的作用。我们采用纵向视角，调查了在德国的城市中，私立小学入学机会的增加与社会经济隔离动态之间的关系。我们利用特别汇编的 2005 年至 2014 年的数据集，预估了具有城市固定效应的线性面板回归模型。该数据集涵盖了 74 个大中城市的 3,500 多个区。分析表明，私立小学比例的增加与德国西部的城市中贫困隔离的减少有关，而与德国东部的城市无关。在德国西部，这两者之间的关联结合当地的具体情况看尤其明显，其特点是贫困居民的比例不断上升，幼儿的比例不断增加。结果表明，择校机会的增加可能会促进居住融合，同时会加剧学校隔离。

关键词

教育、街区、居住隔离、择校、空间不均衡性

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Introduction

In the past two decades, socio-economic residential sorting has increased substantially in many cities across Europe and the United States (Bischoff and Reardon, 2014; Musterd et al., 2017). The uneven distribution of households within urban space by income, education or occupation is termed socio-economic segregation. The place where a person lives – particularly if it is a deprived area – can be consequential for their individual outcomes such as educational attainment, career prospects and health, as research on neighbourhood effects has documented (see e.g. Chetty et al., 2016; Galster, 2012). It is children who are most affected, probably through effects of social learning.

Still, few quantitative studies have set out to understand what drives changes in socio-economic segregation over time (Bischoff and Reardon, 2014; Musterd et al., 2017; Owens, 2016; Reardon and Bischoff, 2011).¹ Owens (2016) found both that income segregation in the largest US metropolitan areas is much higher among families with children and that it increased almost exclusively among this group; she concluded that:

‘When accounting for rising income segregation, factors specific to families with children must be taken into account’ (Owens, 2016: 559). One explanation for her findings is that parents’ schooling considerations contribute to their residential choices (Owens, 2016: 566). The role of school options in shaping processes of residential sorting has only recently gained more scholarly attention, with a focus on the United States (Candipan, 2019; Pearman and Swain, 2017; Rich et al., 2021). These scholars argue that expanding school choice weakens the traditional link between housing and schooling decisions, especially for families with a higher socio-economic status (SES), thereby affecting residential segregation patterns.

In this article, we investigate whether the availability of school choice accounts for cities’ segregation dynamics in the distinct national setting of Germany. The country has a long history of residence-based assignment to public primary schools. Unlike in the United States, in Germany the only widespread non-neighbourhood choice options are private schools. Since reunification, the share of students attending private schools has constantly grown (Klemm et al., 2018: 9, 17). As in other European countries,

the level of socio-economic residential segregation in Germany is considerably lower than in the United States, but it has also increased over the last decades (cf. Helbig and Jähnen, 2018: 6ff, 28ff; Musterd et al., 2017: 1070). German children are much more segregated by income than the overall population (Helbig and Jähnen, 2018: 44ff). But unlike in the United States, their uneven distribution has not grown more strongly than overall segregation in all cities.

Against this backdrop, we adopt a longitudinal perspective and examine how the increasing availability of private primary schools is related to changes in urban socio-economic segregation over time. A uniquely compiled data set allows us to address this research question for the first time in a European country. We combine various data sources in a new way to create a longitudinal data set for the years 2005 to 2014, covering 74 large and medium-sized German cities with over 3500 neighbourhoods. Besides information on the share of private primary schools, we included further characteristics at the city level that reflect the local context. Our outcome of interest represents one important dimension of income segregation: the segregation of poverty. We use the term to refer to the uneven distribution of poor and non-poor households across neighbourhoods (cf. Reardon and Bischoff, 2011: 1097). In order to measure it, we calculate the index of segregation for the recipients of social assistance benefits. In Germany, these benefits are granted to individuals in long-term unemployment or with an income below the poverty threshold. Methodologically, we go beyond cross-sectional studies on the correlates of socio-economic segregation by estimating linear panel regression models with city fixed effects.

We find a segregation-reducing effect of private primary schools in West German cities, but not in East German ones. This

association is especially present in local contexts marked by growing rates of poor residents and growing proportions of young children. Our empirical results imply that, with increasing school choice, the socio-economic divide might run less between residential districts but more between public and private primary schools. Hence, the present study highlights the interconnection between school choice and patterns of spatial inequality.

Primary school choice in Germany

For more than 100 years, primary schools in Germany have had the task of teaching all children together for four to six years, depending on the federal state (Helbig, 2018: 17). Subsequently, students transition to different secondary schools that qualify them for various educational and occupational careers. As tracking takes place very early, a good primary education is often seen as key to attending the academic track (*Gymnasium*) – still the most common way to receive a university entrance qualification.

At first glance, there does not seem to be much of a choice for German parents: allocation to public primary schools is organised via catchment areas, that is, students are assigned on the basis of their residence (Fincke and Lange, 2012: 4ff). This system generates a tight link between place of residence and school location (cf. Candipan, 2019: 3309), so that schools reflect the social composition of their neighbourhood (Butler and Hamnett, 2007: 1164f). An exception can be found in the most populous federal state of Germany, North Rhine-Westphalia (NRW): starting in the school year 2008/2009, NRW abolished compulsory catchment areas for public primary schools (Groos, 2015; Ramos Lobato and Groos, 2019).

Parents who want their children to attend ‘good’ schools can adopt three different choice strategies (Butler and Hamnett, 2007: 1167): first, where rigid catchment systems are in place, they can use residential mobility (Boterman et al., 2019: 3058, 3071; Kauppinen et al., 2021: 18). Oeltjen and Windzio (2019) investigated family moves and perceived neighbourhood quality in three German federal states and found that the lack of a desired primary school nearby greatly increased the relocation rate. As a second educational strategy, parents can apply for their child to attend a different school, with approval being subject to various criteria, or they can illegally provide a false address in order to send their child to their preferred public primary school (Noreisch, 2007). This strategy requires parents to make great efforts while, at the same time, facing great uncertainty. Studies on three large German cities suggest that about 10% of children attend a different public primary school than the one they were assigned to (Fincke and Lange, 2012: 6; Groos, 2015: 21). The third strategy parents may choose is to opt out of the regular public school sector. In Germany, there are two choice options: one within the public, one within the private school sector.

The first choice option is *public* denominational schools, which are a peculiarity in NRW (Riedel et al., 2010). Like regular public schools, they are completely publicly funded, but they are Catholic or Protestant. Because they make up a substantial share of primary schools, they allowed parents in NRW a greater freedom of choice even before catchment areas were abolished. This is the reason why NRW has very few private primary schools compared to other federal states (Helbig, 2018: 18).

In the other 15 federal states, *private* schools are the only school of choice for primary education. They are typically denominational schools, Waldorf schools or

Montessori schools. Because private primary schools are exempted from the catchment system, they attract parents who are seeking to avoid their local school (Boterman et al., 2019: 3068). Despite the label ‘private’, these schools receive most of their funding from the state; in addition, they often charge tuition fees (Klemm et al., 2018: 21ff). This is important, as the ‘organisation of funding impacts [...] the affordability and thus accessibility (of parts) of the educational system’ (Boterman et al., 2019: 3058). The German constitution (*Grundgesetz Art. 7 Abs. 4*) stipulates that private schools can only be approved if they do not foster the segregation of students by parental resources. In reality, the level of fees is often unconstitutionally high, impeding access for low-income families (Wrase and Helbig, 2016). Various studies have found that the composition of students attending private schools in Germany is socially selective, especially at the primary level (Helbig et al., 2017; Klemm et al., 2018: 39ff).

Notwithstanding criticism, private schools have undergone expansion since the beginning of the 1990s: as a proportion of all general schools, private schools rose from 4.5% in 1992 to 10.8% in 2015 (Helbig et al., 2017: 357). One factor was the ‘catching up’ of East Germany, where very few students attended a private school in 1992 (cf. Klemm et al., 2018: 17). Moreover, there has been a proliferation of private schools in urban areas – in some larger cities, as many as 25% to 40% of all primary schools are private (Helbig, 2018: 18).

Explanations for segregation: An integrated theoretical framework

Residential segregation along socio-economic (or ethnic) lines is a multi-factor phenomenon usually explained by the interplay between differentiated housing supply, households’ preferences and resources and

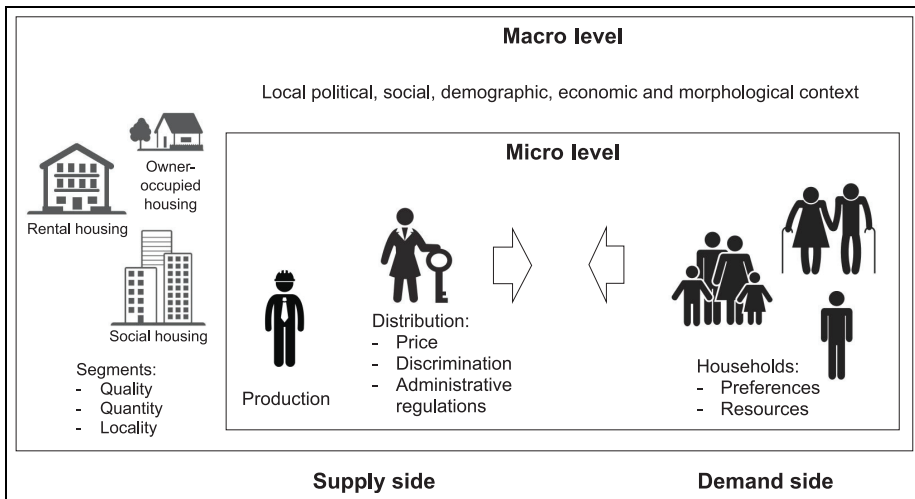


Figure 1. Explanations for residential segregation at the micro and macro level.

Source: Authors' illustration following Musterd et al. (2017) and van Kempen and Özüekren (1998: 1644ff). Pictograms: Getty Images.

the way housing is allocated to the population (e.g. Häußermann, 2012: 390). In the following, we present an integrated conceptual model for investigating segregation and clarify how private schools, which are the focus of our analyses, fit in. The theoretical framework may also guide future research on changing segregation patterns. We combine supply and demand-oriented approaches with a contextual approach that stresses the importance of macro-developments. As illustrated in Figure 1, we distinguish between the supply and demand side of the housing market and between micro and macro level.

On the demand side, private *households* are the main actors (Farwick, 2001: 57f). They decide on the place of residence based on their preferences and resources. Preferences vary with life-course stage, household composition, educational level, occupation, ethnicity and lifestyle. As Owens (2016: 550) notes, 'parents likely pay special attention to the local structure of school options'. But whether households are

able to put their preferences into practice depends largely on their economic (and cultural/social) resources (Farwick, 2001: 58; Friedrichs, 2000: 177).

On the supply side of the housing market, a range of actors decide on the *production* and *distribution* of housing (Farwick, 2012: 384). Suppliers establish specific entry barriers, thereby acting as gatekeepers. Three basic allocation mechanisms can be differentiated: price, discrimination and administrative regulations.

When we only look at the *micro level*, patterns of spatial inequality seem to be the cumulative result of individual decisions (cf. Häußermann and Siebel, 2004: 154). While established theories of residential sorting often describe an interplay between micro and macro factors, they lack an explicit conceptualisation of the latter. Van Kempen and Özüekren (1998: 1644ff) emphasised that economic, demographic and political macro-developments should be included when explaining segregation: housing market players act within the context of the

countries, regions and cities they live in. Similarly, Musterd et al. (2017) identified four universal structural factors and four local contextual factors that contribute to socio-economic segregation. Contextual factors include economic, social, political and morphological (physical) layers. Based on these two systematisations, we extend our theoretical framework by adding a *macro level* that includes the local context: political, social, demographic, economic and morphological factors shape socio-economic segregation by affecting the supply or demand side of the housing market. We acknowledge that the national context is important, too. But since we investigate only one national setting in this article, we leave this context out for the sake of simplicity.

Following Owens (2016: 550), we argue that school policy – and the resulting local school options in the form of private schools – is an important *political* factor that potentially affects the residential decisions of families with children. In addition to educational policy, housing (allocation) policy plays a major role in shaping patterns of spatial inequality (Friedrichs and Triemer, 2009: 40). Regarding the local *social* context, socio-economic segregation is linked to social inequality, in particular income inequality (cf. Reardon and Bischoff, 2011). The *demographic* context refers to the number and composition of households and migration. Bischoff and Reardon (2014: 208) identified increases in income inequality and in the proportion of children as crucial correlates of growing income segregation at the metropolitan level. *Economic* aspects include labour market changes and the supply structure in the three segments of urban housing markets, each serving a different demand: rental housing, owner-occupied housing and social housing (cf. ILS and ZEFIR, 2003: 10; Tammaru et al., 2016: 10). Besides the quality of housing, its quantity and location determine the supply structure (Farwick,

2001: 59f). Last but not least, cities have to deal with *morphological* structures in the sense of a ‘spatial heritage’. Empirically, the different contextual factors may partially overlap with one another, but the theoretical model is helpful for distinguishing various macro-level factors in the study of residential segregation.

School choice and residential segregation

In this study, we investigate how the expansion of private schools in urban contexts is associated with changes in socio-economic residential segregation. Past research suggests that households with children take schooling options into account when they make residential decisions (see e.g. Butler and Hamnett, 2007; Kauppinen et al., 2021; Lareau and Goyette, 2014). These considerations have probably gained weight because education has taken on greater significance for social mobility and reproduction (Butler and Hamnett, 2007: 1162). In Germany, where students are tracked around age 10, concerns about good education are raised early on among higher-SES parents.

Research has only recently begun to investigate more thoroughly the link between school choice and residential sorting. Most studies focus on the United States, where parents have many school choice options, including magnet, charter and private schools (cf. Candipan, 2019: 3310). The central argument is that school choice expansion weakens the neighbourhood–school link because it decouples residential and schooling decisions for specific families (Candipan, 2019, 2020: 215; Pearman and Swain, 2017: 214; Rich et al., 2021: 473f): higher-SES and white families are more likely to make use of such choice options because school-related preferences and resources vary by SES and race (Candipan, 2020: 217). These families are more willing and able to avoid

neighbourhood public schools that they perceive as low quality based on their student composition (cf. Fincke and Lange, 2012; Holme, 2002).

For the United States, Pearman and Swain (2017) found that school choice expansion facilitates gentrification, defined as 'socioeconomic ascent of previously disinvested central-city neighborhoods' (Pearman and Swain, 2017: 213). This finding has implications for residential segregation, as gentrification can initially foster social integration and may only later increase socio-spatial inequality (cf. Musterd et al., 2017: 1078). Candipan (2019) distinguished neighbourhoods on four different trajectories of socio-economic change or stability in order to study the compositional mismatch between public schools and the neighbourhoods they serve. Over time, the majority of schools became less white than their surrounding neighbourhoods. This racial gap grew most strongly in neighbourhoods undergoing socio-economic ascent – even more as the number of nearby schools of choice increased. In another study with individual-level data, Candipan (2020) showed that opting out of assigned neighbourhood schools was more likely when there were other options nearby, especially in gentrifying neighbourhoods. In these kind of neighbourhoods, recent movers opted out more than long-time residents. Rich et al. (2021) investigated the impact of school choice on racial sorting processes simultaneously for schools and neighbourhoods. They observed an increase in Black–White school segregation and a decline in White–Black residential segregation in metropolitan school districts with growing charter enrolment shares.

In Germany, research on school choice and its consequences mostly relies on evidence from NRW. Scholars showed that school choice is dependent on both parental social status and the social and ethnic

composition of the local school (Groos, 2015: 25; Ramos Lobato and Groos, 2019; Riedel et al., 2010): if that school is socially disadvantaged or attended by a higher percentage of immigrants, the likelihood of opting out grows overall and with increasing social status. There are also differences by neighbourhood type, as found in the United States: in socially mixed inner-city areas, higher-SES parents are particularly likely to make use of free school choice (Ramos Lobato and Groos, 2019).

So far, no study has looked at private schools in Germany, the only primary schools that parents can choose in all other federal states, and how they might be related to residential segregation. For parents who want to avoid their assigned neighbourhood school, going private is an alternative strategy to residential mobility. While intra-urban moves to 'good' school districts would increase residential (and school) segregation (Boterman et al., 2019: 3071), the existence of a private school market may decrease residential income segregation (Nechyba, 2003) because housing decisions can be made independently of schooling decisions.

We argue that when more private school options are available, higher-SES families will be more likely to live in lower-income neighbourhoods while at the same time avoiding their assigned local school (cf. Nechyba, 2003: 61). These families might either move into or remain in mixed neighbourhoods in order to benefit from lower rents. During our investigation period, rents in major German cities have continuously increased, most substantially since 2010 (Kholodilin and Michelsen, 2020: 687). The conditions in the rental housing segment are of special relevance because Germany has the second lowest homeownership rate among OECD countries (Kaas et al., 2020). Rising rents have made moving into 'good' neighbourhoods, which is an alternative to choosing private schools, more expensive.

Private schools are an attractive option for higher-SES parents who have specific preferences regarding school social and ethnic composition; these parents also have the necessary resources to send their child to a private school (cf. Riedel et al., 2010: 97). Resources are important because parents need to pay the school fees, which are comparatively low in international comparison but too high for low-income families (cf. Wrase and Helbig, 2016). Moreover, parents have to shoulder the travel costs (direct expenses and longer travel times) attached to this decision.

In sum, we conceptualise the increasing availability of private primary schools in Germany as a local political context factor and hypothesise that it is related to a decrease in residential income segregation at the city level. Specific constellations might make school choice options even more relevant for residential sorting: when more children in a city are socio-economically disadvantaged, as reflected in the student bodies of neighbourhood schools, higher-SES parents may be more likely to opt out. Prior research has found that income inequality and the proportion of children are correlates of changes in residential segregation by income (Bischoff and Reardon, 2014: 225). We expect private school expansion to be particularly important in socio-demographic contexts characterised by both increasing income inequality and increasing proportions of young children.

Data and method

Data

We tested the formulated hypotheses using a uniquely combined longitudinal data set that links multiple data sources for 74 large and medium-sized German cities, covering the period from 2005 to 2014. Data for 51² cities came from the inner-city spatial monitoring project (*Innerstädtische Raumbewachung*,

IRB) of the Federal Institute for Research on Building, Urban Affairs and Spatial Development (BBSR) (BBSR, 2019).³ It relied on the municipal statistics of the IRB cities and the Federal Employment Agency statistics. For this project, uniformly defined items are collected on a yearly basis on the district (*Stadtteil*) level. Except for one, the IRB cities we drew on are large cities with at least 100,000 inhabitants. In addition, we asked all cities that do not take part in the IRB and currently have (or had at least once during the observation period) at least 100,000 inhabitants to deliver comparable data.⁴ In the process, we gathered data on 23⁵ further cities. In total, our compiled data set contained 3509 districts (as of 2014), which we used as a proxy for neighbourhoods. On average, 5475 individuals (mean of inhabitants under age 65) live in the spatial units of our city sample.

We merged these data with indicators from various other data sources that reflect contextual change at the city level. First, we took information on the share of private primary schools from the municipal education database (StBaL, 2016), data deliveries from two state statistical offices (BLaS, 2016; LZDS, 2016) and an online database on schools in East Germany (Helbig et al., 2018). Second, we used the INKAR database (*Indikatoren und Karten zur Raum- und Stadtentwicklung*) of the BBSR. Third, the BBSR generously provided us with data on the rental prices in the cities under investigation (BBSR, 2018).

For each city, we measured the uneven distribution of recipients of social assistance benefits pursuant to Book II of the Social Security Code (SGB II, commonly known as *Hartz IV*) as the outcome variable. As no official statistical data on income are available on a small-scale level in Germany, income segregation is typically studied as the segregation of poverty (see e.g. Farwick, 2012; MAIS, 2016: 405ff). The group of

benefit recipients is a good indicator for two reasons: first, it captures both the long-term unemployed and persons who earn so little that they additionally receive benefits. Either way, their income is very low, which impairs their life chances. Second, we measured low income not only for one person in a household (e.g. a lone mother) but also for all other individuals in the household who received benefits pursuant to SGB II (also children). There are two limitations to keep in mind: we could not include the segregation of poverty for older people, since benefits pursuant to SGB II only apply to the population below age 65. Besides this, there is an unknown number of people that are eligible to receive benefits but do not apply for them.

Since the social security system underwent a huge reform (*Hartz IV*) in 2005, we analysed socio-economic residential segregation from 2005 onwards. Our analyses ended in 2014 for two reasons. First, the influx of about 890,000 refugees in 2015 (BAMF, 2019: 10) might have affected both ethnic and socio-economic segregation in Germany (cf. Helbig and Jähnen, 2019). Once asylum seekers are recognised, they also receive social assistance benefits if needed. Second, as of 2016, there has been a slight change in the composition of the statistics of social assistance recipients by the Federal Employment Agency (BA, 2015). It is unclear whether this had an effect on the measured level of socio-economic segregation.

Method

Methodologically, we go beyond previous cross-sectional studies on the determinants of socio-economic segregation. There are two major problems with cross-sectional analyses of segregation levels (cf. e.g. Florida and Mellander, 2015; MAIS, 2016: 405ff): On the one hand, they tend to ignore the ‘intrinsic logic of cities’ (Löw, 2012). On the

other, comparing cities with greatly differing inhabitant numbers per spatial unit can yield very different results according to the modifiable areal unit problem (MAUP; see Wong, 2009). That is why we estimated linear panel regression models with city fixed effects (using *xtreg* in Stata) to investigate how contextual changes at the city level were associated with changes in socio-economic segregation levels between 2005 and 2014. These panel data models control for any unobserved time-constant characteristics of the individual cities (e.g. morphological structures). Because these models only compare changes over time within cities, they probably provide more causal evidence than cross-sectional models (cf. Bischoff and Reardon, 2014: 221). All models include cluster-robust standard errors (by city) to avoid understatement (cf. Bertrand et al., 2004).

Measures

Dependent variable. For each year from 2005 to 2014, we calculated the established *index of segregation IS* (Duncan and Duncan, 1955) *for benefit recipients*, which represents the evenness dimension of residential segregation (Massey and Denton, 1988). It measures the uneven distribution of one population group compared to the rest of the population across defined spatial units (Häußermann and Siebel, 2004: 140f). Unlike other indices, the IS has the advantage of being easy to calculate, to interpret and to compare with previous studies. The index is computed as

$$IS = \frac{1}{2} \sum_{i=1}^n \left| \frac{x_i}{X} - \frac{t_i - x_i}{T - X} \right|,$$

where n represents the number of spatial units within the city, x_i is the number of poor residents in unit i , X is the total number of poor residents in the city, t_i is the number of residents in unit i and T is the

total number of residents in the city. The resulting segregation value for the entire city ranges between 0 (even distribution) and 1 (complete segregation). It can be interpreted as the percentage of the population group under study that would have to move to another spatial unit in order to reach an even distribution across all units. In our case, these are the districts of each city. Their size varies between and even within the cities, which limits the comparability of IS values between cities in a cross-sectional perspective. Accounting for baseline differences between the cities, our fixed effects models focused on changes in segregation levels over time. Thus, the MAUP should be of minor importance.

Key independent variables. Our key predictors measure local context factors at the city level. The availability of school choice options was operationalised as the *share of private primary schools* in all primary schools. We expected increasing school choice to be of particular importance in socio-demographic contexts marked by growing income inequality and growing proportions of young children. To measure social inequality, we looked at the bottom and top of the social hierarchy: the share of poor residents is captured by the *rate of benefit recipients* among all persons under age 65. As data on high-income earners are not available, we used the *share of university graduates* from the INKAR database as a proxy for high cultural capital, which is closely linked to economic capital. The database also provides the *share of children under age six* in the total population of a city. To test whether private school expansion is more strongly associated with residential integration in particular socio-demographic contexts, we included interaction terms between both *private schools*, *benefit recipients and children* and *private schools*, *university graduates and children*.

Control variables. We used the *year* in its metric form as a control variable. Based on past work, we also controlled for city-level characteristics that are associated with both income segregation and the key independent variables (Bischoff and Reardon, 2014: 217f; MAIS, 2016: 432ff; Pearman and Swain, 2017: 218f): logarithmised *population size* (all persons under age 65), *district size* (mean of population under age 65) and the *level of initial and re-letting rents*. Information on rents was provided by the BBSR and weighted by us against the county-specific (*Kreise*) household income from the INKAR database.

Results

Descriptive findings

Before moving to the panel regression models, we present central descriptive statistics in Table 1. Our outcome, the index of segregation for benefit recipients, varies considerably between the 74 cities, with a range from 10 to 41%. Still, it grew in the vast majority of our city sample between 2005 and 2014. On average, to reach an even distribution across the cities, 26% of all poor residents would have had to move to another district. Our key predictor, the share of private primary schools, also has a large variance: from 0% to a maximum of 40%, with 8.1% as the mean. Figure 2 additionally illustrates the variation in the share of private primary schools over time. On average, it grew by more than 3%, with a larger increase at the top of the distribution.

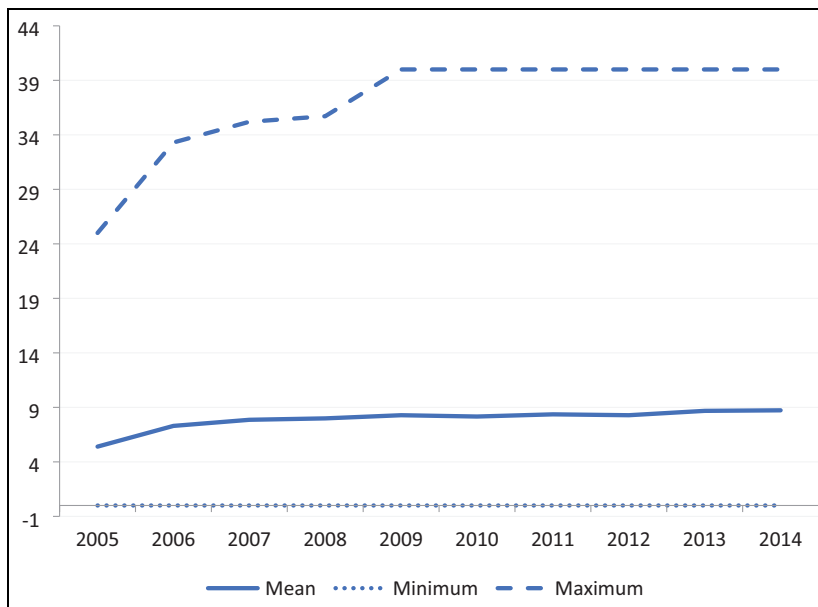
Multivariate findings

How are changes in school choice availability and in the socio-demographic context associated with changes in the segregation of poverty at the city level? In order to answer this question, Table 2 reports estimates from a series of linear panel regression models with city fixed effects predicting socio-

Table 1. Variable description.

| Variable | Mean | SD | Minimum | Maximum |
|---|-----------|-----------|---------|-----------|
| Index of segregation (benefit recipients) | 0.26 | 0.59 | 0.10 | 0.41 |
| Share of private primary schools | 8.1 | 8.2 | 0 | 40 |
| Rate of benefit recipients | 13.5 | 4.6 | 3.4 | 24.7 |
| Share of university graduates | 15.1 | 6.1 | 5.5 | 36.2 |
| Share of children under age 6 | 5.2 | 0.4 | 4.0 | 6.4 |
| Year | 2009.9 | 2.74 | 2005 | 2014 |
| Population size (under age 65) (log) | 285,767.8 | 397,357.5 | 49,203 | 2,879,189 |
| District size (under age 65) | 5475.2 | 2915.8 | 1009.6 | 13,689.9 |
| Level of rents in € per m ² | 6.6 | 1.5 | 4.5 | 14.0 |

Note: Without centring by mean and standard deviation.

**Figure 2.** Variation in the share of private primary schools 2005–2014.

economic segregation. The models control for year, population size, district size and level of rents.

In Models 1 and 2, we look at all 74 German cities of our compiled sample. In Model 1, the coefficient for the year (presented at the bottom) is positive and significant, meaning that socio-economic segregation has increased over time.

Notably, there is no relation between city-district size and segregation (results not shown) – so the MAUP seems to be less of a problem when looking at socio-economic segregation over time. Our key predictor is the share of private primary schools. Contrary to our expectations, the respective coefficient indicates that greater availability of school choice is not associated with

Table 2. Linear panel regression models with city fixed effects predicting socio-economic segregation.

| Variable | Germany | | West Germany | | Only NRW | | West Germany without NRW | |
|--|------------------|------------------|------------------|------------------|------------------|------------------|--------------------------|------------------|
| | Model 1 | Model 2 | Model 3 | Model 4 | Model 5 | Model 6 | Model 5 | Model 6 |
| Private primary schools | −0.002 (0.004) | −0.004 (0.003) | −0.006* (0.003) | −0.005 (0.003) | 0.024 (0.015) | −0.008** (0.003) | 0.024 (0.015) | −0.008** (0.003) |
| Benefit recipients | 0.002 (0.010) | 0.006 (0.008) | 0.017* (0.007) | 0.018** (0.007) | 0.015 (0.008) | 0.021* (0.008) | 0.015 (0.008) | 0.021* (0.008) |
| University graduates | 0.004 (0.006) | 0.002 (0.006) | 0.007 (0.005) | 0.006 (0.005) | 0.019* (0.008) | −0.001 (0.006) | 0.019* (0.008) | −0.001 (0.006) |
| Children <6 | 0.012** (0.004) | 0.007* (0.003) | −0.002 (0.003) | −0.001 (0.004) | −0.005 (0.004) | −0.002 (0.005) | −0.005 (0.004) | −0.002 (0.005) |
| Private schools×benefit recipients | | −0.000 (0.003) | | 0.004 (0.004) | | | | |
| Private schools×university graduates | | 0.003 (0.002) | | 0.002 (0.003) | | | | |
| Private schools×children <6 | | 0.004 (0.003) | | −0.003 (0.005) | | | | |
| Private schools×benefit recipients | | 0.004 (0.003) | | −0.007* (0.003) | | | | |
| Private schools×children <6 | | 0.002 (0.003) | | −0.003 (0.002) | | | | |
| Private schools×university graduates×children <6 | | | | | | | | |
| Year | 0.010** (0.003) | 0.012** (0.003) | 0.009** (0.003) | 0.010** (0.003) | 0.001 (0.006) | 0.016*** (0.004) | 0.001 (0.006) | 0.016*** (0.004) |
| Constant | 0.250*** (0.001) | 0.247*** (0.002) | 0.244*** (0.003) | 0.244*** (0.003) | 0.255*** (0.018) | 0.254*** (0.004) | 0.255*** (0.018) | 0.254*** (0.004) |
| N | 617 | 617 | 490 | 490 | 197 | 293 | 197 | 293 |
| R ² (within) | 0.450 | 0.510 | 0.374 | 0.389 | 0.505 | 0.361 | 0.505 | 0.361 |

Note: Variables centred by mean and standard deviation. Cluster-robust standard errors (by city) are in parentheses. All models controlled for population size (log), district size and level of rents. Berlin was counted among East Germany.
 NRW: North Rhine-Westphalia. *** $p < 0.001$. ** $p < 0.01$. * $p < 0.05$.

changes in the segregation of poverty. Out of the four predictors, only changes in the share of children under age six are statistically significantly and positively associated with changes in socio-economic segregation, net of controls. In Model 2, we introduce interaction terms between private primary schools and the socio-demographic context to test whether school choice availability is particularly important in cities with increasing income inequality and increasing proportions of young children. Again, the coefficients are non-significant.

In Models 3 and 4, we look solely at cities in West Germany because the expansion of the private school sector after reunification followed quite different paths in East and West: in West Germany, the pace of expansion was more gradual, but in the East the private school sector started virtually from zero and has grown remarkably (cf. Klemm et al., 2018: 17). With respect to socio-economic residential segregation, East German cities (including Berlin) have experienced a similar process of ‘catching up’; they showed both higher levels of spatial inequality and steeper increases in spatial inequality than West German cities during our observation period (cf. Helbig and Jähnen, 2018: 28ff). In Model 3 on West Germany, increases in the share of private primary schools are statistically significantly associated with a decrease in the segregation of poverty, as hypothesised. In East Germany, there is no such relation (results not shown). Consistent with prior research, socio-economic segregation increases with growing rates of benefit recipients. Moving to the interaction terms in Model 4, we also observe the predicted compound effect of political and socio-demographic factors: the coefficient for the interaction between private schools, benefit recipients and children is negative and significant, suggesting that the association between school choice availability and segregation is particularly

pronounced in cities that have a growing rate of poor residents and an increasing share of young children.

We further validated the results for West Germany by splitting the cities in Model 3 by federal states: Model 5 is restricted to cities in NRW, where public denominational schools have enabled school choice for a long time and where catchment areas for primary education were abolished in 2008. Here, the coefficient for private primary schools is negative but non-significant. Model 6 includes all West German cities with the exception of those in NRW. In this case, the respective coefficient shows that the greater availability of private primary schools is only related to decreasing segregation in places where schooling is closely linked to catchment areas.

Concluding discussion

The expansion of the private school sector has increased school choice availability for parents in Germany, and especially for those in urban settings over the last decades. These choice options loosen the traditional neighbourhood-school link, allowing higher-SES families to live in mixed neighbourhoods while avoiding local public schools. In this study, we considered the increasing availability of private primary schools as a local political context factor and examined whether it was associated with socio-economic segregation dynamics in cities. To answer this question, we drew on a uniquely compiled longitudinal data set that included 74 German cities. Results showed that an increase in the share of private primary schools was related to a decrease in the segregation of poverty in West German cities. This association was particularly pronounced in socio-demographic contexts characterised by growing rates of poor residents and growing proportions of young children. The much more dynamic

development of both private school expansion and socio-economic residential segregation after reunification may explain why we did not find the predicted effects in East German cities.

Though we investigated a distinct national context with a different ‘educational landscape’ (Boterman et al., 2019: 3057) and lower segregation levels, our main finding is consistent with previous work on the United States: where school choice options expand, residential segregation (modestly) declines. This has been found for different school types and for socio-economic and ethnic divisions: while Nechyba (2003) introduced a private school market in simulations of residential income segregation, Rich et al. (2021) studied the effect of charter school expansion on sorting patterns by race. Although charter schools are public, they share some features with German private schools: they do not make up a large share of schools but are especially present in cities. Moreover, they are expanding and non-integrative (cf. Rich et al., 2021: 474). Increasing charter school enrolment was linked to a notable increase in Black–White school segregation and a rather small decrease in residential segregation – which is not surprising, as residential sorting is a multi-factor phenomenon.

Our findings suggest that educational policy has consequences that go far beyond the educational sphere: school choice availability likely promotes the residential integration of private school attendees, thereby lowering urban segregation. At the same time, it may reinforce school segregation. This trade-off between neighbourhood and school segregation is not a simple zero-sum game, as Rich et al. demonstrated. We share their assessment that ‘[s]mall gains in residential integration do not outweigh the costs of school segregation’ (Rich et al., 2021: 493). Private school attendance in Germany is already socially selective, especially at the primary level (Helbig et al., 2017; Klemm et al.,

2018: 39ff). Expanding school choice has the potential to foster the sorting of public and private primary schools along socio-economic lines, thus exposing children to stratified learning contexts. For policy-makers, one way to ameliorate the resulting problems is by allocating funds to schools according to the social and ethnic composition of the student body. More fundamentally, an integrated approach to housing and school policies is needed, given that neighbourhood- and school-sorting processes are closely intertwined.

While this study highlights the role of schools in the formation of socio-spatial inequality, it has some limitations that should guide further research. First, we rely on aggregate-level data in our analyses, which bears the risk of an ecological fallacy. Because we use panel regression models with city fixed effects that only compare changes over time within cities, we more likely obtain causal estimates than cross-sectional models. Future work should corroborate our findings with evidence on individual motives and decisions regarding housing and schooling. Second, we focus on the segregation of poverty as a central outcome because of data availability. US research found that some metropolitan-level factors are related to changes in overall income segregation and the segregation of affluence, but not to changes in the segregation of poverty (Bischoff and Reardon, 2014: 223). Thus, we would expect to find somewhat different results if data on the full income distribution were included. Finally, it is worthwhile to look more closely at the residential segregation of families with children when investigating the effects of increasing school choice.

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Notes

1. In a reanalysis with corrected estimates, Reardon et al. (2018) showed that the central results of previous studies on income segregation (Bischoff and Reardon, 2014; Owens, 2016; Reardon and Bischoff, 2011) hold, but that the increase after 2000 was only half as large as previously calculated.
2. Aachen, Augsburg, Berlin, Bielefeld, Bochum, Bonn, Bremen, Chemnitz, Cologne, Darmstadt, Dortmund, Dresden, Duisburg, Düsseldorf, Erfurt, Essen, Frankfurt a. M., Freiburg, Fürth, Halle (Saale), Hamburg, Hannover, Heidelberg, Ingolstadt, Jena, Karlsruhe, Kassel, Kiel, Koblenz, Konstanz, Krefeld, Leipzig, Lübeck, Ludwigshafen, Magdeburg, Mainz, Mannheim, Mülheim a. d. R., Munich, Nuremberg, Oberhausen, Offenbach, Potsdam, Regensburg, Rostock, Saarbrücken, Stuttgart, Weimar, Wiesbaden, Wuppertal and Würzburg.
3. For the calculation of socio-economic segregation in Berlin, we drew on data delivered by the statistical office of Berlin and Brandenburg (AfSBB, 2016). Until 2010, the Berlin IRB data were delivered for the 195 statistical areas and only afterwards for the 447 LOR (*Lebensweltlich orientierte Räume*) that we use.

4. Flensburg and Neubrandenburg are exceptions because they have slightly fewer than 100,000 inhabitants.
5. Bergisch Gladbach, Braunschweig, Bremerhaven, Cottbus, Erlangen, Flensburg, Gelsenkirchen, Gera, Hagen, Hamm, Herne, Leverkusen, Mönchengladbach, Neubrandenburg, Neuss, Osnabrück, Paderborn, Pforzheim, Schwerin, Siegen, Trier, Ulm and Wolfsburg.

References

- AfSBB (2016) *Datenlieferung des Amtes für Statistik Berlin-Brandenburg. Berechnet auf Basis der Daten der Bundesagentur für Arbeit zu SGB-II-Beziehern im Alter von unter 15 und über 15 Jahren*. Potsdam: Amt für Statistik Berlin-Brandenburg
- BA (2015) *Revision der Statistik der Grundsicherung für Arbeitsuchende nach dem SGB II. Erweitertes Zähl- und Gültigkeitskonzept. Methodenbericht*. Nuremberg: Statistik der Bundesagentur für Arbeit.
- BAMF (2019) *Migrationsbericht der Bundesregierung. Migrationsbericht 2016/2017*. Nuremberg: Bundesamt für Migration und Flüchtlinge.
- BBSR (2018) *Datenlieferung der Erst- und Wiedervermietungsflächen sowie deren Standardabweichung für die Jahre 2004 bis 2016*. Bonn: Bundesinstitut für Bau-, Stadt- und Raumforschung.
- BBSR (2019) *Innerstädtische Raumbearbeitung (IRB). Dokumentation der Datensammlung*. Bonn: Bundesinstitut für Bau-, Stadt- und Raumforschung.
- Bertrand M, Duflo E and Mullainathan S (2004) How much should we trust Differences-in-Differences estimates? *The Quarterly Journal of Economics* 119: 249–275.
- Bischoff K and Reardon SF (2014) Residential segregation by income, 1970–2009. In: Logan J (ed.) *Diversity and Disparities: America Enters a New Century*. New York: The Russell SAGE Foundation, pp. 208–233.
- BLaS (2016) *Datenlieferung des Bayerischen Landesamtes für Statistik: Zahl der Grundschulen und Waldorfschulen der Schuljahre 2005/06 bis 2015/16*. Munich: Bayerisches Landesamt für Statistik.

- Boterman W, Musterd S, Pacchi C, et al. (2019) School segregation in contemporary cities: Socio-spatial dynamics, institutional context and urban outcomes. *Urban Studies* 56(15): 3055–3073.
- Butler T and Hamnett C (2007) The geography of education: Introduction. *Urban Studies* 44(7): 1161–1174.
- Candipan J (2019) Neighbourhood change and the neighbourhood-school gap. *Urban Studies* 56(15): 3308–3333.
- Candipan J (2020) Choosing schools in changing places: Examining school enrollment in gentrifying neighborhoods. *Sociology of Education* 93(3): 215–237.
- Chetty R, Hendren N and Katz LF (2016) The effects of exposure to better neighborhoods on children: New evidence from the Moving to Opportunity experiment. *American Economic Review* 106(4): 855–902.
- Duncan OD and Duncan B (1955) A methodological analysis of segregation indexes. *American Sociological Review* 20(2): 210–217.
- Farwick A (2001) *Segregierte Armut in der Stadt. Ursachen und soziale Folgen der räumlichen Konzentration von Sozialhilfeempfängern. Stadt, Raum und Gesellschaft; Bd. 14.* Opladen: Leske + Budrich.
- Farwick A (2012) Segregation. In: Eckardt F (ed.) *Handbuch Stadtsoziologie*. Wiesbaden: Springer VS, pp. 381–419.
- Fincke G and Lange S (2012) *Segregation an Grundschulen: Der Einfluss der elterlichen Schulwahl*. Berlin: Sachverständigenrat deutscher Stiftungen für Integration und Migration.
- Florida R and Mellander C (2015) *Segregated City. The Geography of Economic Segregation in America's Metros*. Toronto, ON: University of Toronto, Rotman School of Management, Martin Prosperity Institute.
- Friedrichs J (2000) Ethnische Segregation im Kontext allgemeiner Segregationsprozesse in der Stadt. In: Harth A, Scheller G and Tessin W (eds) *Stadt und soziale Ungleichheit*. Opladen: Leske + Budrich, pp. 174–196.
- Friedrichs J and Triemer S (2009) *Gespaltene Städte? Soziale und ethnische Segregation in deutschen Großstädten*. 2nd edn. Wiesbaden: VS Verlag für Sozialwissenschaften.
- Galster GC (2012) The mechanism(s) of neighbourhood effects: Theory, evidence, and policy implications. In: van Ham M, Manley D and Bailey N (eds) *Neighbourhood Effects Research: New Perspectives*. Dordrecht: Springer, pp. 23–56.
- Groos T (2015) *Gleich und gleich gesellt sich gern. Zu den sozialen Folgen freier Grundschulwahl. Arbeitspapiere wissenschaftliche Begleitforschung "Kein Kind zurücklassen!"*; Bd. 5. Gütersloh: Bertelsmann Stiftung/Zentrum für interdisziplinäre Regionalforschung.
- Häußermann H (2012) Wohnen und Quartier: Ursachen sozialräumlicher Segregation. In: Huster E-U, Boeckh J and Mogge-Grotjahn H (eds) *Handbuch Armut und Soziale Ausgrenzung*. 2nd edn. Wiesbaden: Springer VS, pp. 383–396.
- Häußermann H and Siebel W (2004) *Stadtsoziologie. Eine Einführung*. Frankfurt a. M. and New York: Campus.
- Helbig M (2018) (K)eine Schule für alle. Die Ungleichheit an deutschen Grundschulen nimmt zu. *WZB Mitteilungen* (162): 17–19.
- Helbig M and Jähnen S (2018) *Wie brüchig ist die soziale Architektur unserer Städte? Trends und Analysen der Segregation in 74 deutschen Städten*. WZB Discussion Paper; P 2018-001. Berlin: Wissenschaftszentrum Berlin für Sozialforschung.
- Helbig M and Jähnen S (2019) *Wo findet "Integration" statt? Die sozialräumliche Verteilung von Zuwanderern in den deutschen Städten zwischen 2014 und 2017*. WZB Discussion Paper; P 2019-003. Berlin: Wissenschaftszentrum Berlin für Sozialforschung.
- Helbig M, Konrad M and Nikolai R (2018) Entwicklung von Schulen in Ostdeutschland 1992–2015. Available at: <https://schulenkar te.wzb.eu/#karte;c=52.552,12.389> (accessed 3 May 2018).
- Helbig M, Nikolai R and Wrase M (2017) Privatschulen und die soziale Frage. Wirkung rechtlicher Vorgaben zum Sonderungsverbot in den Bundesländern. *Leviathan* 45(3): 357–380.
- Holme JJ (2002) Buying homes, buying schools: School choice and the social construction of school quality. *Harvard Educational Review* 72(2): 177–206.

- ILS and ZEFIR KP (2003) *Sozialraumanalyse – Soziale, ethnische und demografische Segregation in den nordrhein-westfälischen Städten. Gutachten für die Enquetekommission "Zukunft der Städte in NRW" des Landtags Nordrhein-Westfalen*. Dortmund and Bochum: Institut für Landes- und Stadtentwicklungsforschung des Landes Nordrhein-Westfalen/Zentrum für interdisziplinäre Ruhrgebietsforschung der Ruhr-Universität Bochum.
- Kaas L, Kocharkov G, Preugschat E, et al. (2020) *Reasons for the low homeownership rate in Germany. Research Brief*. 30th edn. Frankfurt a. M.: Deutsche Bundesbank.
- Kauppinen TM, van Ham M and Bernelius V (2021) Understanding the effects of school catchment areas and households with children in ethnic residential segregation. *Housing Studies*. Epub ahead of print 1 February. DOI: 10.1080/02673037.2020.1857707.
- Kholodilin KA and Michelsen C (2020) *Wohnungsmarkt in Deutschland: Trotz Krise steigende Immobilienpreise, Gefahr einer flächendeckenden Preisblase aber gering*. DIW Wochenbericht 37/2020. Berlin: Deutsches Institut für Wirtschaftsforschung.
- Klemm K, Hoffmann L, Maaz K, et al. (2018) *Pri-vatschulen in Deutschland. Trends und Leistungsvergleiche*. Berlin: Friedrich-Ebert-Stiftung.
- Lareau A and Goyette K (2014) *Choosing Homes, Choosing Schools*. New York: Russell Sage Foundation.
- Löw M (2012) The intrinsic logic of cities: towards a new theory on urbanism. *Urban Research & Practice* 5(3): 303–315.
- LZDS (2016) *Datenlieferung des Landesamtes für Zentrale Dienste des Saarlandes: Zahl der Grundschulen und Waldorfschulen der Schuljahre 2005/06 bis 2015/16*. Saarbrücken: Landesamt für Zentrale Dienste des Saarlandes, Statistisches Amt, A131.
- MAIS (2016) *Sozialbericht NRW 2016. Armuts- und Reichtumsbericht*. Düsseldorf: Ministerium für Arbeit, Integration und Soziales des Landes Nordrhein-Westfalen.
- Massey DS and Denton NA (1988) The dimensions of residential segregation. *Social Forces* 67(2): 281–315.
- Musterd S, Marciniak S, van Ham M, et al. (2017) Socioeconomic segregation in European capital cities: Increasing separation between poor and rich. *Urban Geography* 38(7): 1062–1083.
- Nechyba T (2003) School finance, spatial income segregation, and the nature of communities. *Journal of Urban Economics* 54(1): 61–88.
- Noreisch K (2007) Choice as rule, exception and coincidence: Parents' understandings of catchment areas in Berlin. *Urban Studies* 44(7): 1307–1328.
- Oeltjen M and Windzio M (2019) Räumliche Segregation durch ungleiche Bildungskontexte? Wahrgenommene Nachbarschaftsmerkmale und Umzüge von Familien. *Kölner Zeitschrift für Soziologie und Sozialpsychologie* 71(4): 651–675.
- Owens A (2016) Inequality in children's contexts: Income segregation of households with and without children. *American Sociological Review* 81(3): 549–574.
- Pearman FA II and Swain WA (2017) School choice, gentrification, and the variable significance of racial stratification in urban neighborhoods. *Sociology of Education* 90(3): 213–235.
- Ramos Lobato I and Groos T (2019) Choice as a duty? The abolition of primary school catchment areas in North Rhine-Westphalia/Germany and its impact on parent choice strategies. *Urban Studies* 56(15): 3274–3291.
- Reardon SF and Bischoff K (2011) Income inequality and income segregation. *American Journal of Sociology* 116(4): 1092–1153.
- Reardon SF, Bischoff K, Owens A, et al. (2018) Has income segregation really increased? Bias and bias correction in sample-based segregation estimates. *Demography* 55(6): 2129–2160.
- Rich P, Candipan J and Owens A (2021) Segregated neighborhoods, segregated schools: Do charters break a stubborn link? *Demography* 58(2): 471–498.
- Riedel A, Schneider K, Schuchart C, et al. (2010) School choice in German primary schools: How binding are school districts? *Journal for Educational Research Online* 2(1): 94–120.
- StBaL (2016) *Kommunale Bildungsdatenbank*. Düsseldorf: Statistische Ämter des Bundes und der Länder.
- Tammaru T, Musterd S, van Ham M, et al. (2016) A multi-factor approach to

- understanding socio-economic segregation in European capital cities. In: Tammaru T, Marcińczak S, van Ham M, et al. (eds) *Socio-Economic Segregation in European Capital Cities*. London and New York: Routledge, pp. 1–29.
- van Kempen R and Özüekren AS (1998) Ethnic segregation in cities: New forms and explanations in a dynamic world. *Urban Studies* 35(10): 1631–1656.
- Wong D (2009) The Modifiable Areal Unit Problem (MAUP). In: Fotheringham SA and Rogerson PA (eds) *The SAGE Handbook of Spatial Analysis*. London: SAGE, pp. 105–123.
- Wrase M and Helbig M (2016) Das missachtete Verfassungsgebot – Wie das Sonderungsverbot nach Art. 7 IV 3 GG unterlaufen wird. *Neue Zeitschrift für Verwaltungsrecht* 35(22): 1591–1598.