

The Social Geography of Education: Neighborhood, Class Composition, and the Educational Achievement of Elementary School Students in Zurich, Switzerland

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Summary: Despite an impressive amount of research and policy intervention no robust pattern of neighborhood effects on educational attainment has previously been identified. Adequate theoretical modeling and the sensitivity of the results to the method of the study are the major challenges in this area of research. This paper elaborates the social mechanisms of neighborhood effects and applies various methodological approaches to test them. Using data from Switzerland, the research reported here has detected heterogeneous effects of neighborhood on elementary school students' educational achievement in Zurich. Although modest in comparison with the effects of classroom composition, these effects appear to be mediated primarily through social integration into a local peer network and are differentiated according to students' gender and their social origin.

Keywords: Neighborhood Effects; Social Composition; Social Interaction; Educational Attainment; Selection Bias; Endogeneity; Instrumental Variables.

Zusammenfassung: Trotz einer beeindruckenden Dichte an Forschung und mehrerer politischer Interventionen ist es bislang nicht gelungen, ein klares Bild von Nachbarschaftseffekten auf den Bildungserfolg zu zeichnen. Wesentliche Herausforderungen bilden diesbezüglich die Formulierung adäquater theoretischer Modelle wie auch die Sensitivität der empirischen Ergebnisse hinsichtlich der verwendeten Methodologie. Dieser Beitrag arbeitet die sozialen Mechanismen der Vermittlung von Nachbarschaftseffekten explizit aus und unterzieht diese unter Anwendung mehrerer methodischer Ansätze einer empirischen Überprüfung. Unter Verwendung von Daten aus der Schweiz zeigen sich dabei heterogene Nachbarschaftseffekte auf den Bildungserfolg von Primarschülern in Zürich. Diese Effekte – obschon bescheiden im Vergleich mit jenen der Klassenkomposition – sind dabei durch die soziale Integration in ein lokales Netzwerk vermittelt und fallen nach Geschlecht und sozialer Herkunft unterschiedlich aus.

Schlagworte: Nachbarschaftseffekte; Soziale Zusammensetzung; Soziale Interaktion; Bildungserfolg; Selection Bias; Endogenität; Instrumentelle Variablen.

1. Introduction

Where you live affects your life chances – from labor market outcomes to deviant behavior and social or physical well-being. In the last 30 years we have witnessed a steep increase in research on neighborhood effects with a wide variety of findings (for reviews see Jencks & Mayer 1990; Sampson et al. 2002; Galster 2012). Meanwhile, the existence of reliable empirical evidence for such effects remains a controversial issue. This undesirable situation seems, at least partially, to be due to methodological problems. Beyond the difficulties of an adequate elaboration of the theoretical framework and the mediating mechanisms of neighborhood effects

(Galster 2008) as well as an accurate operationalization of the spatial scale of 'neighborhood' (Lupton 2003; Andersson & Malmberg 2013), the statistical modeling and identification of associated mechanisms remain as major concerns (Manski 1993; Galster & Hedman 2013). The selection of people into different neighborhoods according to unobserved characteristics which in turn influence the outcome of interest (selection bias) and the problem of endogenous and simultaneous effects (reflection problem), are together the main statistical challenges in the field of neighborhood effects.

Therefore, the controversial status of empirical evidence can partially be explained by the method adopted by the study. Whereas regression-based (hierarchical) models usually find strong evidence for neighborhood effects (e. g., Crane 1991; Helbig 2010), they become less significant or are even absent in the case of studies which make use of coun-

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terfactual methods and quasi-experimental designs (Harding 2003; Brännström 2004). The analysis of mobility programs in the United States completes the rather inconsistent picture. While significant effects have been found in the case of the Gautreaux program (Rosenbaum 1995), the empirical evidence on the Moving to Opportunity (MTO) experiment indicates differentiated effects on subgroups (e.g., boys and girls; see Orr et al. 2003; DeLuca et al. 2012). This fact not only reflects the great difficulties in conducting large scale experiments in a natural setting over a longer period of time (Heckman & Smith 1995) but especially the dependence of the empirical evidence on neighborhood effects upon the method under study (Galster & Hedman 2013). The inconsistent pattern of neighborhood effects becomes even more problematic if these results end up as the basis for policy interventions on a small (e.g., neighborhood or community renewal; Lupton 2003) or large scale (e.g., housing reform or mobility programs) and would become – at best – a waste of money if the underlying mechanisms were not fully understood both theoretically and empirically.

The aim of this paper is twofold. First, it explicitly elaborates the theoretical mechanisms of neighborhood effects on educational attainment, paying special attention to the social mechanisms at work as well as the potential confusion with school effects (Hedström 2005; Galster 2012). Second, it develops a methodological framework that addresses the problem of selection bias and endogenous effects and applies this model to an empirical test of neighborhood effects on the educational achievement of elementary students in Zurich, Switzerland.¹ Thereby, the present contribution asks for whom and why, rather than just if, neighborhood matters (Sharkey & Faber 2014). To proceed according to this promise, the next section starts by elaborating the relevant mediating social mechanisms. Building on this theoretical background, information on the case of the city of Zurich and the data is delivered in the third section, and the fourth section presents the analytical strategy. The results are presented in the fifth section. The finding of heterogeneous effects, which is robust after controlling for classroom influences and selection bias, stresses the importance of social integration as a social mechanism of neighborhood effects. The paper concludes with remarks on the policy implications of these

results and future challenges in the field of neighborhood effect studies.

2. Mechanisms of Neighborhood Effects

Following the seminal work of William J. Wilson (1987), a broad set of theoretical approaches for the explanation of neighborhood effects have been proposed. In what follows the paper focusses on the effects of socialization processes in varying contexts and the diffusion of (deviant) norms on educational outcomes. Special attention is paid to the mediating mechanisms of these processes, for example, the role of peers as well as the challenging differentiation of school and neighborhood effects. Institutional influences (Häussermann 2003), a third potential approach to neighborhood effects, are not addressed in this article.

2.1. Epidemic Theory

According to Wilson (1987), the fundamental idea of the epidemic theory claims the development of a social milieu in deprived (inner-city) neighborhoods with norms that differ from the rest of the society – at least partially in terms of attitudes toward the labor market, welfare dependence, deviant behavior, or the value of education (Jencks & Mayer 1990; Galster 2012). As the focus on deprived neighborhoods suggests, the consequences of such a milieu are perceived as negative. To understand the core of the epidemic theory we need to elaborate the circumstances of both the development of different norms, attitudes, aspirations, and their ‘contagious’ diffusion, as well as how they respectively affect children’s educational achievement.

Regarding the first point, we can think of two different mechanisms to explain the way in which people adopt new norms in the neighborhood context: through interaction with others (Häussermann 2003: 150; Galster 2012: 25) or through the observation of behavior. Both mechanisms trigger a process of social learning (Friedrichs & Blasius 2005: 23). The relevant aspect of both, however, is the acceptance and internalization of these norms by the individual. As Crane (1991) as well as others (Andersson & Malmberg 2013; Sharkey & Faber 2014) have pointed out, such effects most likely differ according to the amount of disposable resources which may compensate for negative externalities (Greenman et al. 2011) as well as according to sex, with boys usually being more impaired by worsen-

¹ To the author’s knowledge, this is the first study to be concerned with neighborhood effects on educational attainment in Switzerland.

ing neighborhood conditions than girls. But how do these norms spread through the neighborhood context? Following Wilson's (1987: 143) illustration, the presence of high-status residents is crucial for the maintenance of societal norms. As we are concerned with elementary students' educational achievement, the transmission of the value of schooling for outcomes in later life (e. g., income) and the negative impact of disruptive behavior are important normative dimensions. Therefore, the absence of high status residents should decrease the prevalence of such attitudes in the neighborhood.

Although these norms are almost never accessed directly, evidence from both the U.S. and the European contexts suggests negative consequences on children's educational performance of a low amount of high status residents in the neighborhood. The studies by Crane (1991), Garner & Raudenbush (1991), Gephart (1997), Buck (2001), and Crowder & South 2003 use cross-sectional or event-history regression models whereas Evans et al. (1992), Foster & McLanahan (1996), Aaronson (1997), Harding (2003) and Galster et al. (2007) use more sophisticated methodologies such as instrumental variables, sibling estimates or propensity score matching to identify such negative consequence. However, there are also studies that do not find this kind of effects (e. g., Plotnick & Hoffman 1999). A notable exception – although not concerned with educational outcomes – is the study conducted by Friedrichs & Blasius (2005). These authors directly assess the mechanisms for the diffusion of norms in deprived neighborhoods in Cologne, Germany. They report higher acceptance of deviant behavior among residents in poor neighborhoods, independent of the duration of residence and the share of neighbors in one's personal network. Additionally, the empirical evidence (Crane 1991) and the conceptualization in terms of a diffusion process according to Schelling's tipping-model suggest an essential nonlinearity. Not surprisingly, the threshold of the share of high status residents differs from context to context and is essentially an empirical question (Galster 2008; 2012). However, a threshold of a proportion of around 5 % high status residents is usually found – a topic we will return to in the empirical section.

Building upon the theoretical considerations and the evidence of epidemic effects, we expect a negative impact of a below-threshold share of high-status neighbors (Hypothesis 1). These effects are expected to differ in accordance with students' social origin (Hypothesis 1a) as social resources to compensate for negative environmental externalities are

unequally distributed. Additionally, empirical evidence also stresses gender differences whereby pronounced neighborhood effects are especially expected for boys (Hypothesis 1b; see Small & Feldman 2012). Furthermore, the perception and acceptance of norms that shape children's attitudes toward schooling (i. e., especially in the form of disruptive behavior) is proposed as the main mediating mechanism (Hypothesis 1c).

2.2. Collective Socialization

The distinction between the epidemic and the collective socialization theory is not always clear-cut as both focus – at least indirectly – on people's behavior in the neighborhood context. However, whereas the epidemic theory is mainly concerned with indirect effects of the intrinsically motivated adaptation to social norms within the neighborhood, the collective socialization perspective stresses the direct effects of social interaction and people's integration into the neighborhood (Putnam 1966). Hence, according to this perspective, neighborhood effects are the result of differential social learning processes determined by one's geographical and social position. The everyday encounter of and interaction with neighbors affects children's cognitive, linguistic, and other learning skills; partly because these encounters serve as role models (non-parental adults; see Crowder & South 2003), partly because these neighbors most likely tend to be peers from whom they learn beyond the usual educational contexts (Jacobs 1961).

Further insight into more specific mechanisms that also consider the identification of the relevant neighborhood characteristics can be gained from studies focusing on neighborhoods' collective efficacy and social cohesion. Neighbors – and especially those of higher social status (Kauppinen 2007; Helbig 2010) – serve as instances of social control and take collective action to pressure schools to set high standards (Duncan & Raudenbush 1999; Forrest & Kearns 2001). The main focus of our concern, however, is the emphasized importance of social interaction and social integration within the neighborhood according to this perspective. More generally speaking, the integration into a neighborhood network provides additional sources of information and support (e. g., tutoring for school age children) and offers access to relevant resources (Galster 2012: 25; see also Granovetter 1973: 1361). Thus, rather than the mere presence of high status residents, effects due to the collective

socialization perspective seem to be the result of social learning processes that are, in turn, a consequence of people's integration into and interaction within the local context.

Evidence for these effects is rather mixed. As already noted, the early experimental analysis of the Gautreaux program found positive effects on educational attainment (e. g., college attendance, graduation rate; see Rosenbaum 1995: 239ff.) whereas the analysis of the MTO intervention reports heterogeneous effects and pronounced gender differences (Orr et al. 2003, 101ff.). These inconsistent results are, at least in part, due to weak experimental treatment; the acceptance of the treatment was selective and members of both the control and the treatment group did not stay in their assigned neighborhoods (Orr et al. 2003: 111). Additionally, qualitative analysis revealed high barriers for those moving into new neighborhood networks, especially for boys and male adults (DeLuca et al. 2012: 210ff.). In contrast, observational studies often find significant positive effects of indicators of good neighborhood quality on educational outcomes (e. g., Ainsworth 2002 and Leventhal & Brooks-Gunn 2000 for the U.S. and for the European context Andersson & Subramanian 2006; Kauppinen 2007, 2008; Brännström 2008; Helbig 2010).

Examples of sophisticated methodological approaches can be found in the field of economics. Using three alternative identification strategies, Gibbons (2002) demonstrates how children with an economically disadvantaged background benefit from higher proportions of accumulated human capital in the neighborhood. Goux & Maurin (2007) used the clustered structure of the data to construct small-scale neighborhoods (i. e., the people in the direct vicinity of one's dwelling). They found significant and, in comparison to other studies, very strong effects on the probability of grade retention. However, many of these studies fail to empirically address or even formulate the mediating mechanism.

Building on the empirical evidence and the theoretical considerations, we expect a positive impact of an increasing share of high status residents on children's educational achievement (Hypothesis 2). Reflecting upon the epidemic theory, this effect is expected to be non-linear (Hypothesis 2a). Additionally, effects according to the collective socialization theory should be mediated by the amount of social integration into the neighborhood (Hypothesis 2b). Those who are embedded into the local context should be subject to greater contextual in-

fluences. However, the heterogeneous effects reported in several studies (e. g., DeLuca et al. 2012) suggest that these effects likely differ according to individual resources (social status) and gender (Hypothesis 2c). These considerations on the theoretical mechanisms will now be distinguished from the other potential effects of local social compositions, mainly those of the school.

2.3. School or Neighborhood Effects?

People choose both the neighborhoods they want to live in as well as the schools to send their children to, and in some situations they choose schools via neighborhoods.² A major concern for the existence of both school and neighborhood effects is the amount of segregation and varying social composition. Negative as well as positive peer effects, due to the differing composition of the student body, motivate one string of arguments, while other arguments focus on institutional differences between schools (e. g., Marsh & Parker 1984; Hattie 2002). As public schools in Zurich have specific school catchment areas within administrative neighborhoods, one would expect that residential segregation due to differences in socio-economic resources and preferences is reflected in the amount of school segregation (Gordon & Monastiriotis 2006). In line with this argument, Rendón (2014) finds neighborhood effects on the propensity to drop out of school to be mediated by school effects. At the same time, other studies that address both contexts simultaneously find neighborhood effects to disappear once school effects are taken into account (Kauppinen 2008; Goldsmith 2009).

In the case of Zurich, the financial resources of public schools are distributed according to the social composition of the school districts, thus benefiting schools in more disadvantaged environments. Hence, differences between schools in terms of their structural aspects (e. g., teaching aids) should be marginal. As a result, once the social composition of the student body in the form of peer effects at the classroom level is taken into account, school effects should be of lesser importance. However, given the partial coincidence of school catchment

² Gordon & Monastiriotis (2006) demonstrate in their study how more affluent parents accept longer ways to school for their children as long as these schools are of a high quality (similarly Hanushek et al. 2003). On the other hand, Cheshire & Sheppard (2004) show how high quality schools affect housing prices in the corresponding neighborhoods.

areas and administrative neighborhoods and the linkage between school and neighborhood choice, it may still be impossible to fully differentiate neighborhood from school effects. Nevertheless, the consideration of school effects provides an additional source for understanding neighborhood influences on academic outcomes; the relevance of relative status and reference groups (Marsh & Parker 1984; Merton 1995). Although this cannot be observed directly in the present study, children might evaluate their own standing and performance in terms of academic achievement and social status against that of their peers in the neighborhood context (e. g., in a process of relative deprivation and cross-pressures – Galster 2012). Hence, the suggested heterogeneous effects of social context according to individual social status might not only be the result of the different resources available for coping with negative and positive externalities but also of more complex processes of social comparison.

3. Data

The data at hand originates from a research project on the determinants of the educational success of migrants. This study was conducted by the Department of Sociology of Education at the University of Bern and funded by the Swiss National Science Foundation.³ Students and their parents were interviewed in two waves in 5th and 6th grade. The dependent variable – mathematical achievement – was chosen because it is an important decision-making parameter for transfer to the secondary school track at the end of 6th grade. At this stage, students are selected into one of three alternatives; high school, upper, or lower secondary school depending on their grades in Mathematics and German.⁴ The sampling of schools in the cities of Bern and Zurich allows for the identification of neighborhoods in both cities. However, as these two cities differ significantly regarding their population size, economic activity, social composition, and their institutional framework (e. g., aspects of the educational system), further complexity and heterogeneity would be introduced if both were to be included. An adequate evaluation of neighborhood effects in both cities would need to take these differ-

ences into account as we would otherwise run the risk of confounding neighborhood with more aggregated effects. Furthermore, the latter may also alter the mediating mechanisms. For example, the noted threshold for an epidemic diffusion of deviant norms could differ in the two cities due to variations in the design and content of the welfare systems that buffer negative externalities of socially disadvantaged neighborhoods.⁵ However, such a differentiated elaboration for both cities is beyond the scope of the present analysis.

$$ID = \frac{1}{2} * \sum_{i=1}^N \left| \frac{p_i^a}{\sum_{i=1}^N p_i^a} - \frac{p_i^b}{\sum_{i=1}^N p_i^b} \right| * 100 \quad (1)$$

As demonstrated in Table 1, Zurich shows a considerable amount of segregation according to social status. For this reason, Duncan & Duncan's (1955) index of dissimilarity was calculated, as shown in equation 1 where p_i^a denotes the share of group A, say high status neighbors in neighborhood i , and p_i^b is the share of the reference group in the same neighborhood.⁶ We can interpret the index as the share of group A that needs to move to achieve an equal distribution. Although people with middling class position and vocational or professional training are almost equally distributed, people with tertiary education or higher class positions are much more segregated. To a lesser degree this is also true for lower class positions, the unemployed and people who did not complete compulsory schooling.

It has to be stressed that this study uses administrative neighborhoods as they are defined by city authorities (see Figure 1). This implies that they may not correspond to people's subjective perception of 'neighborhood' (Lupton 2003). Furthermore, while most of these administrative neighborhoods consist of 5'000 to 15'000 inhabitants, there are several with up to 20'000 and one consists of more than 30'000 inhabitants. This should be kept in mind as the relatively large neighborhoods might not reflect all the relevant processes for neighborhood effects. However, as was argued earlier, these neighborhoods are associated with school catchment areas and therefore might capture other aspects for the

⁵ Similar arguments can be made in the case of the collective socialization hypothesis. Social services (e. g., day care centers) provide additional contexts of social learning for children. However, the provision of such institutions most likely differs between the two cities.

⁶ A well-known and important weakness of the index of dissimilarity is its dependence on geographical scale: the larger the units, the smaller the measured amount of segregation (Wong 1997).

³ 'Determinanten des Bildungserfolgs von Migranten im Schweizer Schulsystem' – DEBIMISS: <http://p3.snf.ch/Project-121610>.

⁴ Grades range from 1, the worst, to 6, where 4 equals 'pass' or 'sufficient'.

Table 1: Social segregation in Zurich

Social position	Total ¹	Percent	Dissimilarity Index
Highest education achieved²	171,914		
Tertiary	41,721	24.68	21.28
Vocational or professional training	79,155	46.03	8.81
Compulsory schooling	43,959	25.56	13.09
Insufficient compulsory schooling	7,079	4.11	18.16
Class position³	197,973		
High	24,680	12.47	21.22
Middling	55,984	28.28	4.16
Low	18,411	9.30	14.88
Unemployed	10,234	5.17	11.54
Not in the labor force	88,633	44.78	7.79

Source: Stadt Zürich 2011, own calculations.

¹ Based on the neighborhoods in the analysis (20 out of 34)

² Age 30 and older

³ Age 25 and older

outcome under study such as children's experiences not only in their immediate residential surroundings but also on their way to school.

Although the neighborhoods differ significantly in their social composition and mean mathematical achievement (Figure 1), the sample is not a cross section of all the neighborhoods in Zurich.⁷ The voluntary participation of principals and teachers led, in relative terms, to an overrepresentation of more disadvantaged neighborhoods; neighborhoods where parents with higher social status were especially likely to return the questionnaires (see Table A7 in the online appendix at www.zfs-online.org). This limitation should be kept in mind when we turn to the empirical results as these relatively resource-rich households might narrow or even absorb potential neighborhood effects (Greenman et al. 2011). As characteristics of social status were ascertained only in the first wave, 525 students in 20 neighborhoods whose parents returned the questionnaire constitute the sample for this investigation. To avoid further loss of cases and, therefore, of statistical power due to missing values, the data was multiply imputed using chained equations (Allison 2001; White et al. 2011). A detailed descrip-

tion of this process can be found in the online appendix of the article.

As we are dealing with a rather small sample, only a narrow set of variables was included to predict mathematical achievement in 6th grade. To test the hypotheses suggested by the collective socialization and the epidemic theory, the main regressor of interest is the share of residents with high social status. In the case of the epidemic theory, the corresponding variable has been recoded into a dummy variable, indicating if one lives in a neighborhood with a share of 5 % or less of high status residents. The threshold was chosen based on empirical evidence on the epidemic theory (e.g., Crane 1991) and is supported by the data at hand (Table 3, Categorical). Additionally, the epidemic theory, as well as empirical evidence on the collective socialization hypothesis, suggest a nonlinear effect. Therefore, the squared share of high status residents is included. Furthermore, we suggested a mediation of the compositional effects via the amount of social integration (collective socialization) and the acceptance of deviant norms regarding schooling (epidemic theory). For the first process, a scale measuring integration into a peer network was constructed. Lacking information on students' networks in the neighborhood, school peers had to be used as a proxy. Yet, as was argued earlier, these most likely coincide as school peers are from the same neighborhood and elementary school-aged children are unlikely to have a spatially dispersed network (Gephart 1997). For the same reason, the acceptance of deviant norms was operationalized as re-

⁷ Additionally, the amount of students per neighborhood varies considerably in the analysis. Whereas the mean is 26.25 students, there are four neighborhoods with between five and seven students, and two with nine students, respectively. This should be kept in mind as it may reduce the statistical power to detect significant differences between neighborhoods.

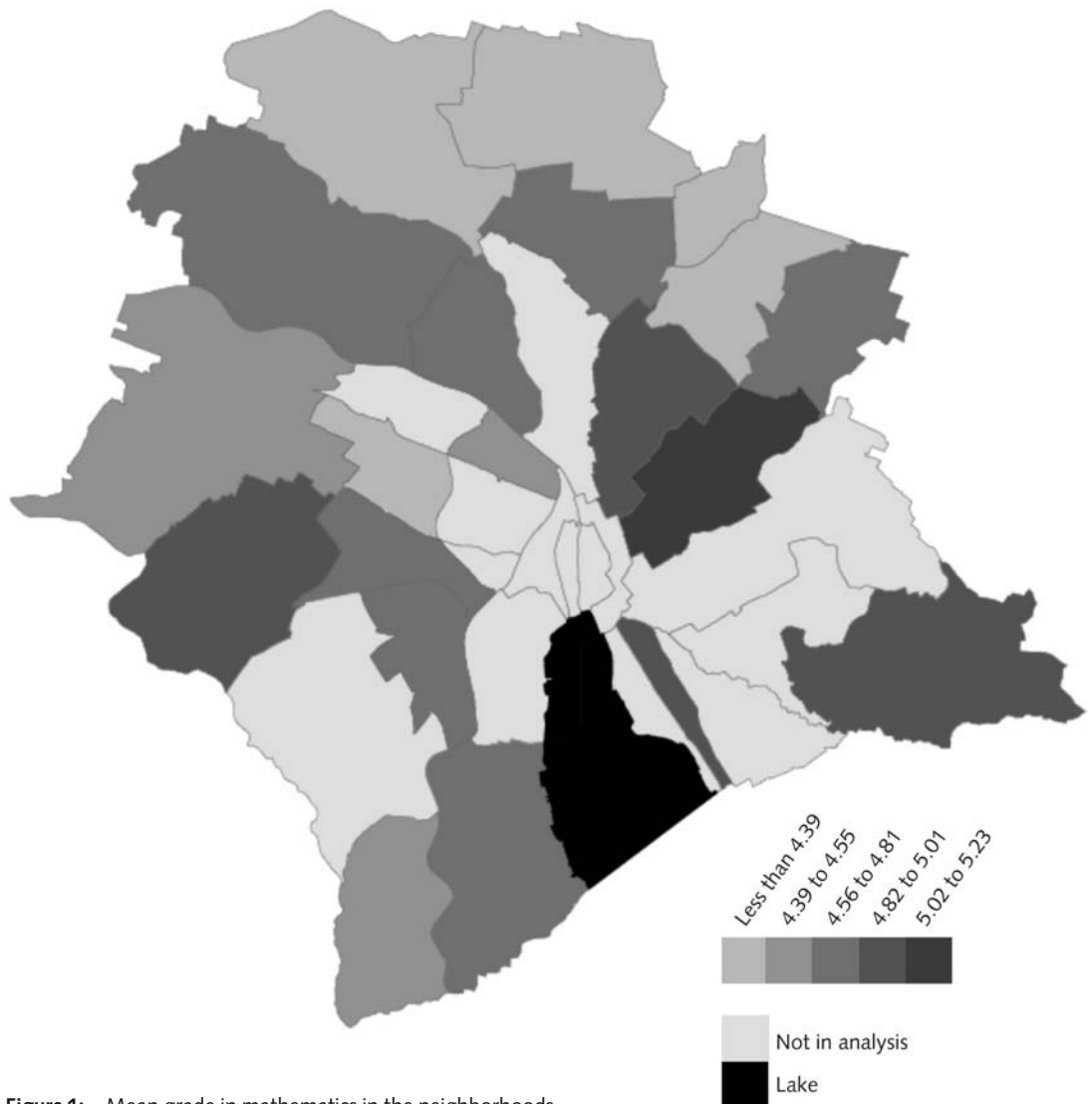


Figure 1: Mean grade in mathematics in the neighborhoods

ported disruptive behavior in everyday school life. With regard to the explanations in the section on the potential confusion of school and neighborhood effects, we may nevertheless consider these two measures as adequate proxies for the mediating mechanisms. The construction of both scales and the included items can be found in Table A8 in the online appendix.

The selection into neighborhoods is a major concern for studies using observational data and will be discussed in the next section. However, the common strategy of conditioning on observables points to the crucial role of measures of social origin

(Bergström & van Ham 2010). Furthermore, these measures are essential determinants of the outcome under study (Boudon 1974). Hence, a reduced Erikson-Goldthorpe-Portocarero class scheme (EGP; parents' highest education becomes insignificant once controlling for class position and is therefore omitted) and the subjective evaluation of the household's monetary situation as a proxy for the possibility of residential mobility are crucial controls. With the data at hand, it is only possible to distinguish between the two service classes (EGP I and EGP II), routine non-manual employees and self-employed (EGP III and IV), skilled or unskilled

workers (EGP V, VI, VII), and people not in paid work such as retirees or homemakers. However, the scheme turns out to be a strong predictor of educational achievement in the present study. Furthermore, the language spoken at home prior to entering school,⁸ student's sex, and a scale measuring problem-solving skills are included as additional controls. The math grade in the first semester of the 5th school year serves as a proxy for differences in abilities. By doing so, potential neighborhood as well as all other effects are reduced to the period of one year. Finally, the average grade in math of each class, computed for every student separately, is included to control for the possible confusion of neighborhood with other compositional effects of the student body.

4. Estimation Strategy

With the small and selective sample at hand, how can we still obtain valid and unbiased empirical evidence of neighborhood effects on educational attainment? As already mentioned, the main concern is the presence of selection bias (Heckman & Smith 1995) as well as the endogenous nature of compositional effects (Manski 1993). Selection bias occurs when unobserved factors influence both the selection into the treatment (i. e., the neighborhood) and the outcome under study. If, for example, due to different lifestyle tastes our measures of social status do a poor job in predicting people's residential choice (Rössel & Hoelscher 2012), and their lifestyles, in turn, influence their children's educational performance due to different parenting practices, we would confound a potential neighborhood effect with an individual effect of people's unobserved lifestyles. On the other hand, the inherent endogeneity of neighborhood effect leads to a confusion of causes and effects. An individual characteristic (e. g., a student's grade in math) contributes to the group's aggregate characteristic (mean achievement in math) which, in turn, again influences the individual characteristic. The identification of endogenous effect is therefore no longer straightforward and can be compared with the possible confusion of a person in front of a mirror and his or her image within it (the origin of the term 'Reflection Problem' as described by Manski 1993). Whereas selection bias is a particular problem in

observational and less so in experimental studies, both kinds have to address the topic of endogenous and simultaneous effects; randomization does not solve the reflection problem (Hanushek et al. 2003: 535). To account for the methodological sensitivity of the results (Galster & Hedman 2013), the pursued analytical strategy complements ordinary least squares with a counterfactual approach and tests multiple specification of the models. In what follows, we further elaborate the problems noted above and present a potential solution.

To estimate neighborhood effects in the present study, let us consider a linear-in-means model as illustrated in equation 2. Y is the outcome of interest (i. e., mathematical achievement), X is a vector of individual, exogenous predictors (e. g., social origin, prior achievement), $E(Y)$ is the (endogenous) classroom peer effect (i. e., average mathematical achievement of all the other students in a classroom), and D is the neighborhood level treatment (e. g., an indicator of whether one lives in a neighborhood above or below the threshold value of the portion of high status residents).

$$Y = \beta_0 + X\beta + E(Y)\rho + D\gamma + \mu \quad (2)$$

$$\{Y_0, Y_1\} \perp\!\!\!\perp D \mid X \quad (3)$$

In this setting we are interested in the treatment effect on the treated (ATT – Angrist & Pischke 2009: 14f.).⁹ The identification of the ATT is restricted by the plausibility of the conditional independence assumption (CIA – equation 3). In a non-random setting, causal effects of the treatment D can only be identified if the treatment is independent of the potential outcomes Y_0 and Y_1 (Angrist & Pischke 2009: 52ff.; Morgan & Winship 2007: 44ff.). This independence is achieved by conditioning on the observed covariates X (selection on observables). If the CIA holds, the estimation of the treatment effect D is unbiased as the selection into the treatment is as if random (Angrist & Pischke 2009: 54). However, if other unobserved factors influence the

⁸ Other measures of migration background are omitted as they are not significant in any model. Similarly, additional controls such as children's and parents' educational aspirations were also omitted due to insignificance.

⁹ Note that a crucial assumption for the identification of treatment effects is most certainly violated in the case of neighborhood effects: the stable unit treatment assumption (SUTVA). SUTVA implies that the treatment status of case i does not affect the outcome of any case's other than its own (Gangl 2010: 26). However, the outlined mechanisms suggest that the interaction among residents is precisely the main reason for potential influences of neighborhood characteristics on a variety of outcomes (Jencks & Mayer 1990; Gangl 2010). One possibility to account for these mutual influences is a spatial regression model with a spatially lagged dependent variable (Ward & Gleditsch 2008).

treatment assignment, estimated differences in outcomes are biased.

Even though it might be possible to model the selection into treatment based on observed characteristics such as individual social status and the financial situation in the household, the problem of the identification of endogenous effect remains (Manski 1993: 532). To illustrate the case, let us further break down equation 2. Following Manski (1993: 533), we can differentiate the treatment D into an exogenous and an endogenous element. In the endogenous case, a person's outcome varies with the average outcome of the reference group defined by X

$$E(Y|X, Z) = \alpha + E(Y|X)\rho + E(Z|X)\gamma + X'\delta + Z'\eta \quad (4)$$

(e. g., peers' achievement as defined by $E(Y|X)$). An exogenous or contextual effect $E(Z|X)$ describes the influence of an exogenous characteristic of the group on individual behavior. Additionally, the term $X'\delta$ in equation 4 covers correlated effects, e. g., influences due to exposure to a shared institutional setting. However, the problem consists in differentiating these effects. As Manski (1993: 535) has shown, the distinction of endogenous from exogenous effects relies on strong assumptions.

The present study addresses both problems – selection bias as well as endogenous effects – by employing an instrumental variable (IV) approach (Angrist & Pischke 2009: chap. 4).¹⁰ Thereby one makes use of an exogenous regressor Z (the instrument) that is correlated with the outcome Y only via its influence on the endogenous regressor D . The exogenously explained variance in D is then used to estimate the effect of D on Y . If the instrument is valid (i. e., if it is sufficiently strong and correlated with the outcome only via the instrumented regressor – the so called exclusion restriction; Angrist & Pischke 2009: 116f.), one obtains the unbiased effect of D on Y . In the present case, our potentially biased estimator D (the neighborhood's social composition) is instrumented by the neighborhood's share of dwellings with more than 5 rooms (for a similar argument see Gibbons 2002).¹¹ Not only is it a sufficiently strong instru-

ment (Shea's adjusted partial $R^2 = 0.4355$ in the baseline collective socialization model; see also Figure 2 and the F-Statistics reported at the foot of Table 4), but it also appears reasonable that its only influence on students' achievement is via the socio-economic mix in the neighborhood. Dwellings with more than 5 rooms are a scarce commodity and, especially in cases such as in the city of Zurich with a low supply of housing, the demand for such accommodation will greatly increase its price. Therefore, only people with sufficient financial resources can afford them. As a consequence, neighborhoods with a higher proportion of dwellings with more than 5 rooms will also become neighborhoods with a higher socio-economic status. However, the treatment effect will only be identified for those whose neighborhood condition is actually affected by the instrument (Gangl 2010).

Not only does the validity of the approach rely on the exclusive link of neighborhoods' mix of dwellings with its social status, but we also need to extend our model in equation 2 with non-linear (squared) and interaction terms in order to test the hypotheses suggested in the prior section. Therefore, heterogeneous treatment effects are considered according to individual social status, sex, social integration within a peer network, and the perception and acceptance of disruptive behavior among friends and peers.

5. Results

In accordance with the theoretical approach, we estimate two linear models to begin with: one for the epidemic and one for the collective socialization hypothesis. These linear models are then further differentiated by the interaction of neighborhood characteristics with parents' social status, student's sex, and the mediating variables (i. e., perceived deviance and social integration). To account for the hierarchical structure (students nested in classes and neighborhoods), observations are clustered at the neighborhood level.¹² In what follows, we concentrate on the main effects of interest – the neighborhood and classroom compositional effects.

¹⁰ The use of instrumental variables with multiply imputed data is risky. Stephens & Unayama (2014) recently showed that the IV-estimator tends to be overstated if the endogenous regressor is imputed. However, if, as in the present case, both the endogenous regressor and the instrument are fully observed, the IV-estimator should be consistent.

¹¹ Alternatively, and as suggested by the literature on residential mobility (e. g., South & Crowder 1997), the proportion of natural green areas in the neighbourhood (such as parks or gardens) was also used as an instrument. How-

ever, the post-hoc test on the instrument's strength resulted in a weak instrument.

¹² Cameron et al. (2011: 238) suggest clustering at the highest hierarchical level in one-way clustering. Furthermore, as 20 neighbourhoods are included in the analysis, the number of higher-order observations should be sufficient (Wooldridge 2003: 133ff.).

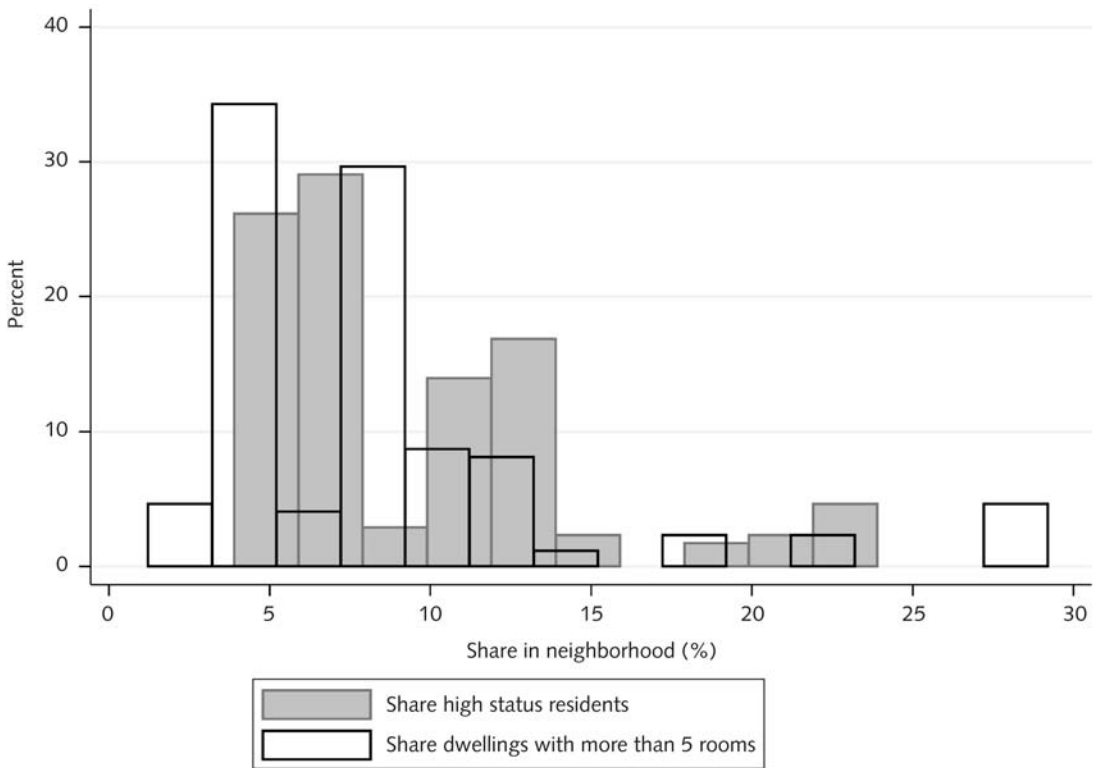


Figure 2: Comparison instrument and instrumented variable

Apart from these, there are effects that are significant and strong for children's social origin and especially for their prior achievement. In some cases, modest effects for problem-solving skills were detected. The financial situation and the language spoken prior to school enrollment remain insignificant in almost all of the models. However, the achievement gain of up to almost half a grade for children from the highest social classes (estimates of the IV models in Table 4) is quite remarkable. It points to the importance of 'primary' effects of social origin (Boudon 1974) on the transition to secondary school and stresses the added value of one's background in the short period of one year as we controlled for prior achievement in 5th grade. Returning to the neighborhoods' social composition, there seems to be mixed evidence for such effects in the case of Zurich. However, let us consider each hypothesis in more detail as we will see that the results are especially driven by some subgroups and the mediating mechanisms.¹³

¹³ The reader may note the conservative significance levels in terms of the reported standard errors (i. e., missing sig-

nificance where the ratio of coefficient to standard error would suggest a t-value beyond the critical value). Although from of a total of 525 there are 353 complete cases, this study nevertheless makes use of the small sample adjustment, resulting in more conservative estimates (Wagstaff & Harel 2011).

In the case of the epidemic hypothesis (i. e., negative effects due to residency in neighborhoods with a share of 5 % or less of high status inhabitants and the associated internalization of differing norms, e. g., impertinence toward teachers), there are literally no effects on educational attainment in the ordinary least squares models (Table 2). Additionally, there are no effects for subgroups according to individual social status or sex. Hence, it comes as no surprise that the inclusion of the suggested mediating mechanism does not reveal any significant neighborhood effect. The picture changes somewhat with regard to the collective socialization hypothesis. Following the considerations discussed in section two, positive (nonlinear) effects of an increasing share of residents with a high social status were expected. Although neither the inclusion of

Table 2: Epidemic Theory – OLS

	Baseline	Girls	Boys	EGP I	EGP II	EGP III, IV	EGP V-VII
Neighborhood characteristic							
5 % or less high status residents	-0.038 (0.069)	-0.047 (0.096)	-0.026 (0.071)	0.016 (0.207)	-0.053 (0.107)	-0.061 (0.091)	-0.041 (0.121)
Perceived deviance	0.010 (0.027)	0.006 (0.039)	0.012 (0.041)	-0.052 (0.041)	0.026 (0.064)	0.038 (0.039)	-0.012 (0.073)
Class position (Reference: Higher service class (I))							
Lower service class (II)	-0.009 (0.056)	0.029 (0.076)	-0.043 (0.086)				
Skilled non-manual & self employed (III&IV)	-0.163* (0.073)	-0.217* (0.077)	-0.079 (0.116)				
Skilled and unskilled manual (V, VI & VII)	-0.193* (0.074)	-0.166 (0.096)	-0.229* (0.116)				
Other: Unemployed, in training, domestic work	-0.276* (0.115)	-0.385* (0.161)	-0.187 (0.154)				
Interactions							
≤ 5 % High status * Perceived deviance	0.001 (0.049)	-0.001 (0.076)	0.010 (0.061)	0.158 (0.180)	-0.149 (0.106)	-0.019 (0.072)	0.007 (0.092)
Sex (Reference: Boy)	0.015 (0.048)			0.051 (0.089)	0.043 (0.080)	-0.080 (0.091)	0.094 (0.087)
Grade 5th school year (Math)	0.728*** (0.046)	0.702*** (0.052)	0.776*** (0.056)	0.781*** (0.067)	0.724*** (0.089)	0.738*** (0.057)	0.720*** (0.076)
Mean grade class level (Math)	0.323** (0.077)	0.397** (0.107)	0.276* (0.105)	0.490** (0.159)	0.153 (0.189)	0.386* (0.171)	0.368* (0.128)
Observations	525	280	245	110	103	123	141
Adj. R ²	0.665	0.665	0.659	0.629	0.590	0.663	0.557

Dependent variable: math grade in 6th school year; additionally controlled for language prior to enrollment, problem solving skills, and financial situation. Constant not reported. Standard errors (corrected for heteroscedasticity at neighborhood level) with small sample adjustment in parentheses.

Source: DEBIMISS, own calculations; estimates based on 200 imputed data sets

* $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

the linear nor the squared share of high status neighbors result in a significant effect (Table 3, Baseline), there is evidence for non-monotonic neighborhood effects if the characteristic is introduced as a categorical variable (Table 3, Categorical). Children from neighborhoods with a 6 to 10 % share of high status residents perform significantly better in math than their peers from less advantaged neighborhoods. This pattern is further enhanced if the analysis is differentiated for girls and boys. While the effects seems to be especially pronounced among girls (they increase their performance by more than a quarter of a grade), boys generally seem to be negatively affected by – in socio-economic terms – more advantaged environments. Ceteris paribus, living in a neighborhood with a 16 to 20 % share of high status residents reduces their

mathematical achievement by 0.211 grades. Turning to the differentiated analysis according to children's social origin, the initial finding can be further illuminated. The positive impact of more affluent neighbors seems to be especially pronounced for the highest status groups (EGP I and to a lesser extent EGP II), whereas the substantive gain of 1.147 grades for students with parents in the higher service class who are living in neighborhoods with a 16 to 20 % proportion of high status residents, seems especially noteworthy. This pattern is additionally supported – although not significantly – by the consistently negative effects for children from less fortunate social backgrounds of higher shares of high status residents (EGP III and IV and EGP V to VIII).

Table 3: Collective Socialization – OLS

	Baseline	Cate- gorical	Girls	Boys	EGP I	EGP II	EGP III,IV	EGP V-VII
Neighborhood characteristics								
% High status in neighborhood	0.012 (0.021)							
% High status in neighborhood (squared)	-0.001 (0.001)							
Share high status residents (Reference: max. 5 %)								
6 to 10 %		0.158* (0.068)	0.294* (0.105)	-0.063 (0.073)	0.384+ (0.199)	0.338* (0.150)	-0.065 (0.132)	0.180 (0.179)
11 to 15 %		0.095 (0.063)	0.173 (0.105)	-0.047 (0.079)	0.268 (0.215)	0.222 (0.138)	-0.070 (0.117)	0.126 (0.180)
16 to 20 %		-0.066 (0.086)	0.450 (0.456)	-0.211+ (0.110)	1.147* (0.495)	0.198 (0.205)	-0.012 (0.213)	-0.418 (0.299)
More than 20 %		-0.040 (0.116)	0.054 (0.164)	-0.186 (0.108)	0.119 (0.270)	0.216 (0.174)	-0.393 (0.262)	-0.099 (0.276)
Social integration	0.002 (0.048)	-0.058 (0.048)	-0.099 (0.061)	-0.029 (0.075)	-0.298 (0.309)	-0.150+ (0.050)	0.002 (0.162)	-0.055 (0.167)
Interactions (Social integration * Share high status)								
6 to 10 %		0.058 (0.059)	0.106 (0.079)	0.022 (0.083)	0.303 (0.334)	0.199+ (0.091)	0.005 (0.167)	0.039 (0.175)
11 to 15 %		0.122* (0.054)	0.113 (0.073)	0.157 (0.099)	0.442 (0.314)	0.163+ (0.076)	-0.050 (0.184)	0.133 (0.179)
16 to 20 %		0.356** (0.091)	-0.315 (0.720)	0.354** (0.090)	-1.358+ (0.699)	0.468* (0.101)	0.484 (0.315)	0.246 (0.257)
More than 20 %		0.022 (0.053)	0.027 (0.086)	0.021 (0.089)	0.264 (0.309)	0.048 (0.115)	-0.038 (0.156)	-0.344 (0.620)
Grade 5th school year (Math)	0.725*** (0.044)	0.736*** (0.045)	0.720*** (0.048)	0.761*** (0.054)	0.783*** (0.077)	0.739*** (0.088)	0.747*** (0.066)	0.743*** (0.076)
Mean grade class level (Math)	0.423*** (0.097)	0.420*** (0.091)	0.497** (0.134)	0.354* (0.137)	0.734* (0.245)	0.162 (0.275)	0.487+ (0.237)	0.492** (0.136)
Observations	525	525	280	245	106	102	123	140
Adj. R ²	0.667	0.672	0.676	0.667	0.642	0.596	0.658	0.568

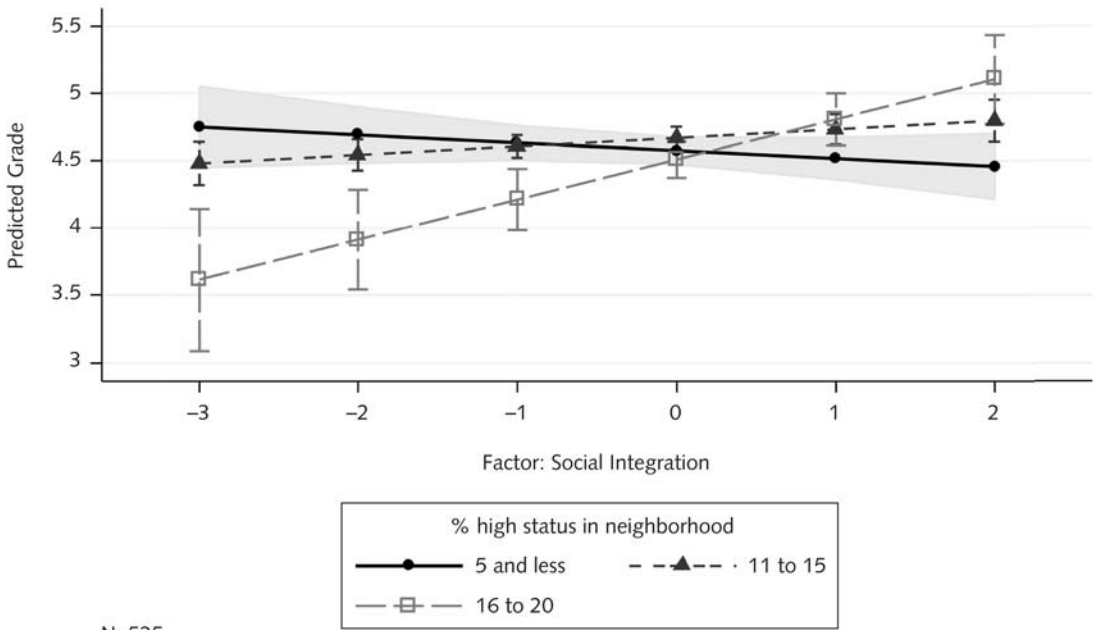
Dependent variable: math grade in 6th school year; additionally controlled for social origin, language prior to enrollment, sex, problem solving skills, and financial situation. Constant not reported. Standard errors (corrected for heteroscedasticity at neighborhood level) with small sample adjustment in parentheses.

Source: DEBIMISS, own calculations; estimates based on 200 imputed data sets

+ $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

While the missing significance in the differentiated analysis might be due to a small number of cases in each of the cells (e. g., only few children with parents in the highest social classes live in the most disadvantaged neighborhoods – Table A8), there is evidence for the crucial role of the suggested mediating mechanism. In terms of mathematical achievement, children benefit from more advantaged environments in the neighborhood if they are well integrated into their local peer network. Figure 3 plots the significant interaction effects of the categorical model in Table 3. Most interestingly, the ef-

fect of the integration into the peer network draws a differentiated picture of neighborhood effects according to the collective socialization hypothesis. The more advantaged the neighborhood in terms of its social composition, the greater the gains of being well integrated into one's peer group. Inversely, in socially disadvantaged neighborhoods, the interaction with peers seems to have a negative impact on one's mathematical achievement. Furthermore, this seems to be especially true for children with parents in lower service class positions (Table 3, EGP II). These findings suggest that the neighborhood



N: 525

Category '6 to 10' and '21 and more' omitted

Figure 3: Share high status in neighborhood and social integration

effect is, indeed, a matter of social integration and thereby, of social interaction.

So far, we have seen no support for the epidemic theory, and only modest support for the collective socialization theory. These results, however, all stem from linear regression models. Although the models are robust regarding violations of prerequisite assumptions, such as homoscedasticity, influential cases, linearity of the continuous regressors, normal distribution of residuals, and multicollinearity,¹⁴ they might be biased due to unobserved selection processes and the presence of endogenous effects. To address these challenges and to test the validity of the results gained so far, an instrumental variable approach was pursued. By instrumenting the neighborhoods' social composition with the share of dwellings with more than 5 rooms, we

¹⁴ Interestingly, the highest, but still unproblematic collinearity, is detected between the average grade in math at classroom level and the proportion of high status residents in the neighborhood (VIF = 1.97 in the complete case analysis). Additionally, a simple test of endogeneity of the average grade in math does not turn out significant (the average grade was first regressed on all other covariates, after which the residuals from this regression were introduced in the baseline model of the collective socialization hypothesis).

obtained unbiased effects of the neighborhood characteristic on students' mathematical achievement.

As we are dealing with imputed data and only one instrument is used, not all heterogeneous treatment effects (i. e., interactions) can be replicated in the IV approach. Imputing the interaction terms would lead to very weak instruments in the case of the categorical collective socialization model. Nevertheless, the results from the IV models complement the interpretation based on the regression analysis. Although only the effect for children from the lowest social classes (skilled and unskilled workers – EGP V to VII) is significant at the 1 % level in the imputed epidemic model, it nevertheless further supports the prior findings from the OLS models. These children score almost half a grade higher in math if living in a neighborhood with 5 % or less of high status residents rather than in a more affluent one. Hence, for them, a less competitive environment seems to enhance their performance. Again, this effect is not moderated by the prevalent norms, proxied by the perceived deviance of peers. Furthermore, the robust Hausman-Test, adjusted for the clustered structure of the data (at the foot of Table 4), suggests an endogenous process to be at work. The present neighborhood effect is, indeed, pro-

voked by social composition rather than other exogenous factors (Manski 1993; Durlauf 2001).

Further evidence in the same direction can be inferred from the IV-estimates according to the collective socialization hypothesis. Again, only the neighborhood effect for children from the lowest social classes is significant. However, note that we are using the metric share of high status residents in the neighborhood, which did not turn out to be significant in the OLS models. These children perform significantly worse with an increasing presence of high status residents in the neighborhood. As in the epidemic model, they seem to suffer from a more competitive environment. Unlike in the prior OLS models, this effect is not mediated by the amount of social integration into a peer network. However, the insignificance of the interaction effect might also reflect the presence of the previously outlined heterogeneous effects (Figure 3; Table 3, Categorical). The question remains as to why the effect is only significant for this particular subgroup – especially given that we did not find any effects for them before. First of all, there may not be sufficient cases present for the other status groups (table A7 in the appendix). Additionally, as demonstrated in Table 3, there is considerable heterogeneity in the neighborhood effects among the subgroups. Considering the previous possible confusion of neighborhood and selection effects, a further explanation emerges. Residential choices are crucially determined by available resources (South & Crowder 1997), whereby people from the lowest social classes can be expected to be those with the least choice. Thus, it is possible that unobserved factors (e. g., further dimensions of social status) influence their mathematical achievement negatively while simultaneously determining their parents' residential 'choice' of low-status neighborhoods.¹⁵ Finally, it should be mentioned that the negative effect for boys misses the marginal significance only slightly ($p=0.106$) and is significant in the complete case analysis (Table A5 in the online appendix) as well as in the model without the interaction with the mediating mechanism.

Summarizing these findings, what can be learned regarding the impact of the neighborhood's social composition on children's mathematical achievement? First of all, there is evidence for neighbor-

hood effects on educational achievement, even after accounting for their endogenous nature and ruling out potential bias due to unobserved selection processes in the IV models. Although the case of Zurich, with its counteracting allocation of school resources and an only moderate degree of social segregation, can be considered as a challenge to neighborhood effects, their mere existence is still far from being astonishing news. Taken together, the results from the OLS and the IV models, however, reveal some interesting and consistent patterns among these effects. In line with previous research (e. g., DeLuca et al. 2012; Andersson & Malmberg 2013), heterogeneous effects for subgroups according to social status and sex were detected. Whereas the (modest) negative effect of an increasing share of high status neighbors for boys is also found in other studies (Orr et al. 2003) and, in the present case, is more than merely cancelled out by the interaction effect for well integrated boys (-0.211 vs. 0.354), the differences across status groups need further attention. For the very same reason, we should pay attention to the classroom effect shown in Table 4. Students from all social classes benefit from better performing peers, except for those with parents in lower service class positions (EGP II). However, in the sample these are, from the start, the best performing students, which suggests a ceiling effect. Similarly, the better the students are integrated into their peer network, the more they benefit from a favorable social environment in the neighborhood. Thus, although the acceptance of school-relevant norms such as disruptive behavior is not a relevant mechanism, the social integration and interaction with peers seems to be a crucial mediating factor. Overall, the results suggest positive impacts from advantaged neighbors only on students from more affluent households while those of lower social origin (EGP V to VII and, to a lesser extent, EGP III and IV), are negatively affected. As the latter are independent of the amount of social integration and therewith, most likely, of social interaction, the results suggest other possible processes at work such as perceived status inconsistency and cross pressures as the result of comparison processes (Merton 1995).¹⁶ Furthermore, although there is evidence for the endogenous nature of neighborhood effects and a non-trivial, non-linear relationship between neighborhoods' social status and children's educational achievement, these effects are rather inconsistent and generally

¹⁵ As the test for endogenous effects did not turn out significant in the case of this particular subgroup (Table 4), social multipliers can be ruled out as an alternative explanation for the difference between IV and OLS estimates.

¹⁶ Comparable empirical evidence for such effects of the neighborhood context are reported in DeLuca et al. 2012.

Table 4: Instrumental Variable estimates

	Model I: Epidemic Theory				Model II: Collective Socialization										
	Baseline	Girls	Boys	EGP I	EGP II	EGP III, IV	EGP V-VII	Baseline	Girls	Boys	EGP I	EGP II	EGP III, IV	EGP V-VII	
Neighborhood characteristic															
5% or less high status residents	0.212 (0.131)	0.245 (0.162)	0.085 (0.181)	-0.042 (0.273)	0.032 (0.261)	0.329 (0.246)	0.472** (0.183)	-0.014 (0.010)	-0.013 (0.012)	-0.021 (0.013)	-0.018 (0.013)	0.001 (0.016)	-0.029 (0.029)	-0.070* (0.032)	
Share high status residents	0.016 (0.025)	0.012 (0.037)	0.018 (0.034)	-0.037 (0.042)	-0.023 (0.050)	0.038 (0.038)	0.004 (0.063)	0.043 (0.051)	-0.011 (0.049)	0.157 (0.098)	0.173 (0.136)	0.025 (0.098)	0.016 (0.081)	0.019 (0.311)	
Perceived deviance								-0.002 (0.004)	0.000 (0.004)	-0.009 (0.007)	-0.007 (0.008)	-0.002 (0.009)	-0.002 (0.005)	-0.000 (0.033)	
Social integration															
Share high status *								-0.026 (0.054)	-0.015 (0.079)	-0.032 (0.080)					
Social integration								-0.193* (0.075)	-0.260** (0.080)	-0.082 (0.112)					
Class position (Reference: EGP I)								-0.231** (0.076)	-0.208* (0.089)	-0.262* (0.119)					
EGP II	-0.032 (0.057)	-0.032 (0.091)	-0.041 (0.086)					-0.320** (0.113)	-0.424** (0.147)	-0.235 (0.163)					
EGP III, IV	-0.185* (0.077)	-0.259** (0.091)	-0.082 (0.114)					0.009 (0.046)	0.009 (0.046)	0.056 (0.072)					
EGP V-VII	-0.232** (0.078)	-0.238* (0.101)	-0.235* (0.113)					0.048 (0.080)	0.056 (0.080)	-0.126 (0.090)					
Other	-0.328** (0.117)	-0.460** (0.164)	-0.201 (0.152)					0.048 (0.072)	0.056 (0.080)	-0.126 (0.090)					
Sex (Reference: Boy)								0.048 (0.072)	0.056 (0.080)	-0.126 (0.090)					
Grade 5th school year (Math)	0.727*** (0.046)	0.696** (0.049)	0.776*** (0.056)	0.774*** (0.065)	0.728*** (0.090)	0.761*** (0.060)	0.697*** (0.069)	0.728*** (0.044)	0.706*** (0.046)	0.764*** (0.057)	0.758*** (0.071)	0.734*** (0.086)	0.755*** (0.064)	0.723*** (0.068)	
Mean grade class level (Math)	0.429*** (0.090)	0.506*** (0.118)	0.330* (0.133)	0.523** (0.173)	0.101 (0.218)	0.516** (0.184)	0.657*** (0.158)	0.477*** (0.114)	0.526*** (0.149)	0.556** (0.178)	0.823** (0.261)	0.094 (0.342)	0.629* (0.310)	0.734*** (0.222)	
Rho / F	-0.404*	-0.481*	-0.182	-0.011	0.002	-0.729*	-0.813**	3.257	0.698	10.041*	0.345	1.844	1.052	2.632	
p	0.034	0.025	0.519	0.978	0.996	0.087	0.007	0.146	0.585	0.015	0.738	0.325	0.406	0.141	
Observations	525	280	245	106	102	123	140	525	280	245	106	102	123	140	

Dependent variable: math grade in 6th school year; instrument: share dwellings with more than 5 rooms in neighborhood - F(Model II Baseline) = 24.970***. Additionally controlled for social origin (class position), language prior to enrollment, problem solving skills, and financial situation; standard errors (corrected for heteroscedasticity at neighborhood level) in parentheses.

Source: DEBIMISS, own calculations. * $p < 0.10$, * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

weak when compared with those at the classroom level. Finally, this, again, might indicate that people's perception and definition of 'neighborhood' does, indeed, coincide only partially with administrative borders and might work at a much smaller level.

6. Discussion

Neighborhood – or, rather, neighbors – matter. The last 30 years have yielded a remarkable amount of empirical evidence on neighborhood effects (Jencks & Mayer 1990; Sampson et al. 2002; Galster 2012). However, influenced by Wilson's (1987) premise of the negative impacts of concentrated poverty in inner-city neighborhoods, most research has focused on disadvantaged areas. Subsequently, and as there are no comparable areas of concentrated poverty, there has been no investigation regarding neighborhood effects on educational attainment in Switzerland to date.

The aim of this paper was twofold. First, it made an effort to assess neighborhood effects on elementary students' educational achievement in the particular case of Zurich, Switzerland. Second, it aimed to advance the understanding of the social mechanisms of neighborhood effects both theoretically and empirically (Hedström 2005; Sharkey & Faber 2014). Therefore, perceived disruptive behavior as a proxy for the prevalence and acceptance of deviant norms in the neighborhood context and the amount of social integration (and thereby, of social interaction) within a local peer network were proposed and tested as the main mediating mechanisms of compositional effects according to the epidemic and the collective socialization theory, respectively (Crane 1991; Galster 2008). Furthermore, the paper did not merely ask whether neighborhood effects occur but, also, for whom and why they occur. Hence, heterogeneous effects according to children's social origin – in terms of the Erikson-Goldthorpe-Portocarero class scheme – and sex were expected (Andersson & Malmberg 2013).

An instrumental variable approach was used to consolidate the findings from clustered linear regression models and to adequately address the problem of unobserved (self-)selection into the neighborhood as well as the potentially endogenous nature of compositional effects. Although the detected effects are rather weak – especially when compared with the impact of the simultaneously evaluated peer effect at the classroom level – they nevertheless provide a consistent picture of the so-

cial mechanism at work. While neighborhood effects in the present study are not mediated through the prevalence of deviant norms, they are subject to endogeneity and social multipliers (Durlauf 2001). In particular, social integration into a local peer network has been identified as the main social mechanism of compositional neighborhood effects on students' mathematical achievement. Such effects are especially pronounced among the well-integrated ones. However, this general statement is challenged by some, at first sight counterintuitive, differentiated effects in the instrumental variable models. The positive impact of high status neighbors in the ordinary least squares models is reversed for children from the lowest social classes. They benefit independently of the mediating mechanisms – perceived deviance and social integration – from a below threshold share (5 % or less) and are negatively affected by the linearly increasing share of high status neighbors. This suggests that alternative processes are at work such as status (in)consistencies and cross-pressures due to the comparison with the reference group in the neighborhood (relative deprivation or 'disadvantage of advantaged neighbors' according to Jencks & Mayer 1990; more generally: Merton 1995) and these can also be found in the literature on school effects (e.g., Marsh & Parker 1984). In line with previous research (Orr et al. 2003; DeLuca et al. 2012), boys appear to be negatively affected by the presence of more advantaged neighbors while girls are more likely to benefit from them. It is important to note that all these effects on students' mathematical achievement in 6th grade occur in the short time of one year as prior achievement in 5th grade is controlled.

Although the existence of confounding interactions of neighborhood with school effects cannot be entirely ruled out despite controlling for effects at the classroom level and taking the balancing effect of resource-allocation among schools into account, the results suggest a number of important implications. As social integration into the local peer network was identified as the crucial mediating mechanism, future research as well as worthwhile political efforts to improve children's educational achievement in less advantaged neighborhoods should pay special attention to this particular aspect. However, taken together with the endogenous effects in some models, this suggests complex interdependencies across students. Future research should also address these interdependencies more explicitly, both analytically and empirically (e.g., with spatial econometric techniques; see Ward &

Gleditsch 2008). Furthermore, the differentiated effects among subgroups suggest that not all students would benefit from potential interventions in the same way and we should particularly discard the view that living in advantaged neighborhoods is per se beneficial.

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