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Indicators for a needs-based resource allocation in early childhood education: Regional data as valid proxies for setting level needs?

Abstract

The main purpose of the study is to investigate whether regional data are able to finance early childhood education settings according to their need. Against the background of constraints in public resources on the one hand and the challenge to tackle educational inequality on the other hand, the current academic and political discussion regards needs-based resource allocation to be a promising answer to both demands. This requires the indicators used to allocate resources to accurately capture the characteristics that result in a greater financial need of educational institutions with respect to educational inequalities. In this regard, policy makers often face a dilemma between available data on the one hand and the quality of these data on the other hand. A possible solution to this dilemma could be the use of statistical data on the level of city districts as an objective and non-manipulable indicator that is easily at hand. However, the employment of these data is only valid if the districts' social composition is similar to the composition of the settings in those districts. I employ data on different needs indicators on both levels in one municipality and analyze their correlation. The results indicate that the characteristics of the districts and their respective preschool settings do not match sufficiently to be an adequate indicator in needs-based resource allocation.

Keywords

Early childhood education; Educational inequality; Needs-based resource allocation; Educational governance

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Indikatoren für eine bedarfsorientierte Finanzierung frühkindlicher Bildung – Sozialraumdaten als valide Proxies für Einzeleinrichtungen?

Zusammenfassung

Die Studie untersucht, ob vorliegende Daten der kommunalen Sozialberichterstattung sinnvoll eingesetzt werden können, um Kindertageseinrichtungen bedarfsorientiert zu finanzieren. Vor dem Hintergrund begrenzter öffentlicher Finanzmittel und der Herausforderung, bestehende Bildungsungleichheiten abzubauen, erscheint akademischen und politischen Diskussionen zufolge eine bedarfsorientierte Finanzierung von Bildungseinrichtungen als geeignete Strategie, beide Anforderungen gleichermaßen zu erfüllen. Eine solche Ressourcenallokation erfordert den Einsatz von Indikatoren, die den Mittelbedarf der Einrichtungen hinreichend genau erfassen. Häufig ist die Suche nach Indikatoren durch ein Spannungsverhältnis zwischen einer ausreichenden Datenverfügbarkeit und -qualität gekennzeichnet. Ein möglicher Ausweg könnte die Verwendung von statistischen Daten auf Stadtteilebene sein, die im Rahmen der kommunalen Sozialberichterstattung vorliegen und zugleich objektiv und nicht-manipulativ sind. Dies setzt voraus, dass die in der Sozialraumstatistik berichtete soziale Komposition der Stadtteile ausreichend genau die Komposition in den Einrichtungen widerspiegelt. Um dies zu überprüfen, werden verschiedene Bedarfsindikatoren auf beiden Analyseebenen mit Hilfe von Korrelationsanalysen zueinander in Beziehung gesetzt. Die Ergebnisse verweisen darauf, dass die Eigenschaften der Stadtteile und der in diesen liegenden Kindertageseinrichtungen nicht ausreichend übereinstimmen.

Schlagworte

Frühkindliche Bildung; Bildungsbenachteiligung; Bedarfsorientierte Finanzierung; Steuerung im Bildungswesen

1. Introduction

In general, federal or state governments and local authorities can employ different strategies to fund public services. Possible financing approaches are either the reimbursement of actual expenditures or the distribution of limited resources according to (a) the size of bids, (b) political patronage (political funding), (c) historical precedent (incremental funding) or (d) some independent measure of need (Agyemang, 2008; Mayston, 1998; Smith, Rice, & Carr-Hill, 2001). In the field of education constraints in public resources on the one hand and the urgent need to tackle existing patterns of educational inequality on the other hand lead to the implementation of needs-based funding strategies in many countries (Department for Children, Schools and Families, 2009; Edwards, Ezzamel, Robson, & Taylor,

1996; Glennerster, Hills, & Travers, 2000; Levacic & Downs, 2004; Ross & Levacic, 1999). While the reimbursement of actual expenditures does not incentivize providers to employ funds economically, the distribution of resources based on bids, political patronage or historical spending patterns have increasingly proved to be unacceptable in terms of equality. The distribution of resources on the basis of some independent measure of need, however, is believed to be economical and adequate for tackling inequalities at the same time (Betts & Roemer, 2007; Chambers, Levin, & DeLancey, 2006; Chambers et al., 2004; Roemer, 1998; Smith, 2003; Woessmann, 2008).

The central assumption of needs-based financing approaches is that the needs of individuals differ from one another and, therefore, the respective resources provided have to differ as well. Thus, instead of distributing resources in a non-selective way, needs-based financing mechanisms intend to allocate public money target-oriented, i.e., according to the actual needs of the benefit recipients. A consequence of such a targeted resource distribution is an economically reasonable budgeting as money is only spent as necessary. Furthermore, this kind of funding also intends to 'level the playing field' as it favors those who have a greater need. While empirical proof for the relationship between needs-based funding mechanisms and educational equality is still lacking (World Bank, 2013), it is reasonable that the concrete design of the allocation mechanism and especially the implemented needs indicators that are used to target the appropriation of funds are crucial prerequisites for needs-based resource allocation to reach its goals. In this regard, policy makers often face a dilemma between available data on the one hand and the quality of these data on the other hand. While it is favorable to employ individual level data, this approach is often connected with complex processes of data collection and/or a lack of comprehensive data. Therefore, educational researchers increasingly engage in finding proxy indicators that adequately describe a setting's need of resources. A common approach is to substitute individual level data by socioeconomic data relating to small areas such as city districts (BMBF, 2010; Smith et al., 2001).

The allocation of money to education providers as a function of the social composition of the neighborhood the setting is located in is only valid if the attribution of these areas' characteristics to the settings' characteristics does not result in any biases regarding the needs estimates. According to Smith et al. (2001) this 'attribution problem' intensifies if the settings draw their users from overlapping catchment areas, which applies in the case of early childhood education. Against this background, the main research question of this study is whether a funding policy that employs regional statistical information on city districts does account for the actual needs of settings. More precisely, it examines whether socioeconomic characteristics of a preschool's neighborhood can be regarded as valid proxies for needs individual children develop and that are dealt with on setting level. I analyze the relationship between regional and individual needs data aggregated on setting level in one example municipality in North Rhine-Westphalia where preschools located within deprived neighborhoods are by law entitled to receive additional funding.

Before the research question is answered, some general arguments are set forth to explain the relevance and principles of needs-based funding in the field of early childhood education.

2. Needs-based resource allocation in early childhood education[1]

2.1 Universal preschool as a context for needs-based resource allocation

There is broad consent in international politics and education research that children from disadvantaged backgrounds (e.g., from poor or migrant families) have a greater need for preschool education than their more privileged peers. Beyond this general agreement, countries developed different strategies to approach educational inequalities in early childhood. Some countries, e.g., the USA, implemented targeted programs like Head Start that only serve disadvantaged children who are defined as being at-risk due to certain eligibility criteria (Schweinhart, 2003). In contrast, most European countries established preschool systems that are available to all children of a certain age group, and there is a growing movement in favor of such a universal preschool system in the USA as well (Barnett, 2010; Boocock, 2003; Bushouse, 2009; Fuller, 2007; Olsen, 2003; Zigler, Giliam, & Jones, 2006). One of the main arguments for universal preschool is that "programs for the poor tend to be poor programs" (Barnett, Brown, & Shore, 2004, p. 4) and that their quality – or rather the lack thereof – does not account for the educational needs of disadvantaged children. Also, research shows that the social composition of the grouping of children impacts their development and that disadvantaged children "do better in settings with a mixture of children from different social backgrounds rather than in settings containing largely disadvantaged groups" (Sylva et al., 2003).

But a universal preschool system can also put at-risk children at a disadvantage if providers do not adequately meet their needs. Regardless of the system in place, children's educational needs differ subject to individual characteristics and family background. Universal preschool programs should be designed in a way that can be described as 'targeted within universal' if they are supposed to tackle educational inequality (Bennett, 2012). 'Targeted within universal' describes a system where access to the program is universal but educational efforts of the professional staff are targeted according to the children's needs. As effective professional practices to support at-risk children are costly (Karoly, Kilburn, & Cannon, 2005), this approach results in a greater financial need of settings with a high proportion of at-risk children. Against this background, a needs-based resource allocation in univer-

1 This study follows the definition of pre-primary education according to the International Standard Classification of Education (ISCED) level 0 (UNESCO, 1997).

sal preschool systems seems a reasonable approach to support the idea of an adequate education for all children.

2.2 Principles of needs-based resource allocation

In needs-based resource allocation the budget a benefit recipient receives is based on professional expertise and scientific methods which attempt to determine the beneficiary's actual need. The corresponding research is labeled as 'costing out' studies (Jimenez-Castellanos & Topper, 2012; Levin & McEwan, 2001). Smith et al. (2001) argue that the individual child should be in the focus of costing out methods in personal services such as early childhood education. The authors refer to "the amount of public funds to be assigned to a person with certain characteristics for the service in question" (p. 219) as capitation.

Mechanical rules are then set up and equally applied to all funded units which can be individuals but also organizations or local authorities. As the distribution rules are often expressed in mathematical formulae, Ross and Levacic (1999) coined the phrase 'needs-based formula funding' in the field of education. The starting point of needs-based formula funding is a basic budget that is the same for all recipients. It is supplemented by needs factors that – if applicable – qualify the beneficiaries for additional resources. The idea is to provide individuals, organizations or local authorities in equal circumstances with equal resources. More precisely, units with a greater need due to certain disadvantages are funded in a way that enables them to cope with their respective challenges. Model (1) exemplifies the basic structure of such a funding formula. In its simplest form the formula consist of a basic budget and a supplement. I base my analysis on the assumption that the financing unit is a devolved organization of a preschool setting. The total budget $\boldsymbol{f}$ the setting $\boldsymbol{s}$ receives is composed of the sum of the costs that are calculated for each child $\boldsymbol{c}$. These costs consist of a basic allocation $\boldsymbol{b}$ that is estimated for every child and increases subject to n needs factors $(\boldsymbol{i_{1c}, i_{2c}, \ldots, i_{nc}})$.

$$f_s = \sum_{c=1}^{c} \left[b * \sum (i_{1c} + i_{2c} \ldots + i_{nc}) \right] \tag{1}$$

While the formula can be expanded by additional elements, I focus on these needs factors as they are the central component in terms of identifying children and thereby settings with a greater need. Whether funding mechanisms are effective in distributing resources according to need depends on the implemented indicators that are used to target the appropriation of funds. They must capture different levels of need accurately. While being essential, the choice of needs factors is heavily constrained by data availability and quality. They have to be "universally recoded, consistent, verifiable, free from perverse incentives, consistent with requirements

of confidentiality and not vulnerable to manipulation" (Smith et al., 2001, p. 238). Although it seems reasonable to fund per capita or at least per setting, information that fulfill these criteria may not be available at these levels.

The absence of adequate individual level data leads to the consideration to use socioeconomic data relating to small areas that are provided by public authorities. Statistical data on the social composition of a city's districts, for instance, are rich and easily available in many countries. Furthermore, this indicator is neither at risk of being manipulated nor discriminative to individual children. The use of data relating to the characteristics of areas instead of individuals, however, is only justifiable if they constitute at least a rough approximation to individual characteristics (Smith et al., 2001). In other words, the social composition of both the districts and the preschool settings in the respective districts has to be sufficiently similar. In the funding of early childhood education this assumption is further threatened by the possibility that preschool settings draw their children from overlapping catchment areas.

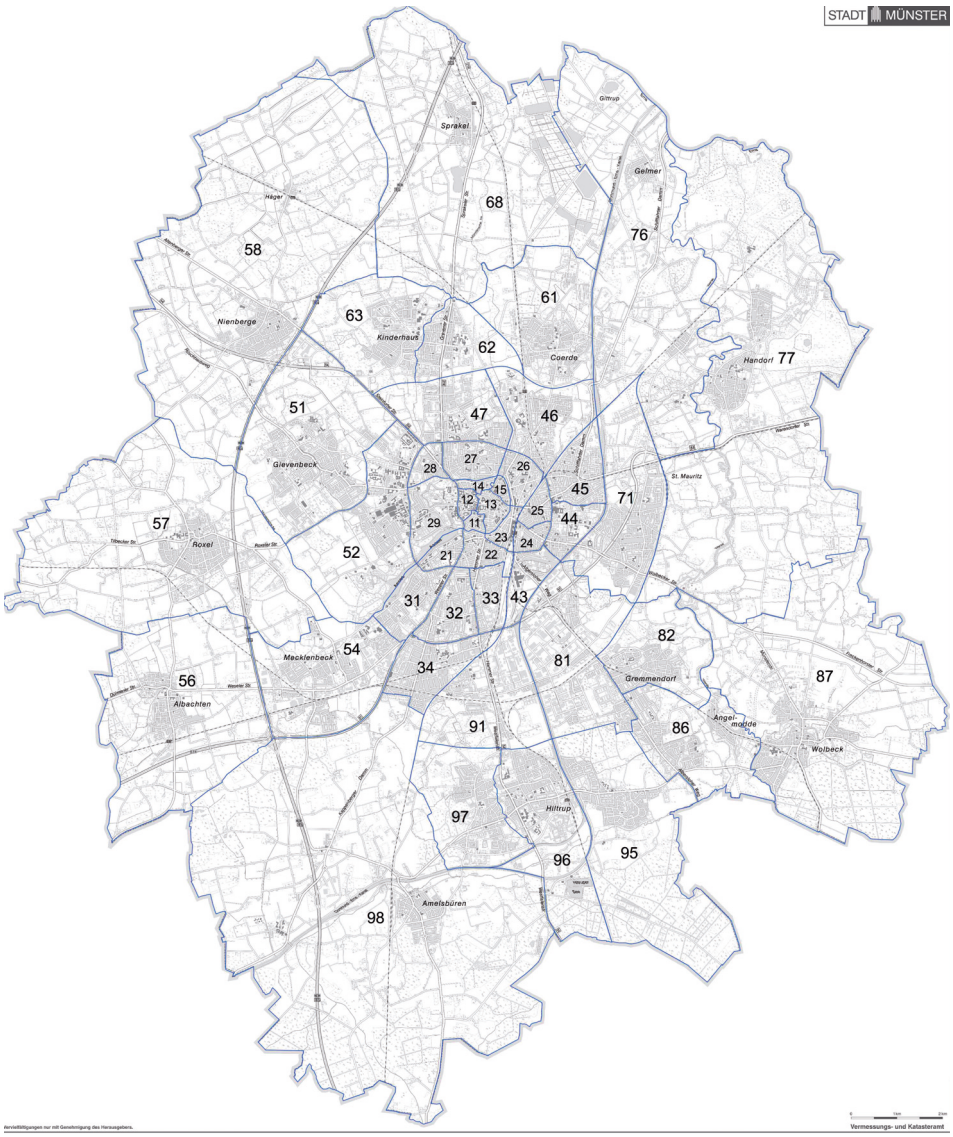
3. Methods

In order to investigate the relationship between neighborhood and early childhood education setting, I analyze characteristics that describe greater need from both levels. The data include information on the proportion of disadvantaged individuals in the settings and their respective neighborhoods. Correlation analyses are employed to detect the coherence between the data on these two levels.

3.1 Data

In Germany most local authorities provide official statistical data on their cities' districts on a small-scale level. I refer to these data as 'municipal official statistics' (MOS). In the current study MOS data are taken from the city of Münster in North Rhine-Westphalia (NRW). Münster is a medium-sized municipality of about 300,000 residents. Compared to other cities in NRW, it is characterized by having a middle and upper class population and being rather wealthy (Zimmer-Hegmann et al., 2006). The city is divided into 45 districts (see Figure 1). The MOS provide differential information on unemployment rates, the proportion of migrants, and family composition and help to describe the districts' population structure in terms of social, demographic, and ethnic segregation.

Figure 1: The division of Münster in 45 districts



Note. The figure shows the city of Münster and its division in 45 districts as provided by the Office for Urban Development and Planning (http://www.muenster.de/stadt/stadtplanung/zahlen.html).

Information on the preschools' composition is taken from the same municipality's school entry examination (SEE) in the years from 2004 to 2011. It entails detailed assessments of totally 20,000 children (between n = 2,360 and n = 2,667 each year) in different domains. Also, background characteristics of the children and their families are gathered in the examination process. As it is known where the children live and which preschool they attend, it is possible to aggregate the

data on district level (n = 40) (SEE_d) as well as on setting level (n = 156) (SEE_s). Concerning the latter, data from three cohorts are aggregated. For instance, the composition of a setting in the 2008/09 school year encompasses data from children that participated in the SEE in 2009, 2010, and 2011. This approach is based on the assumption that the majority of children participates for three years in center-based early education programs. This hypothesis is not only supported by regional data for the municipality in question (Hüsken, 2011); the SEE data themselves reveal that 87 % of the children visited a preschool setting for about three years in 2007 to 2011.[2] The settings' identification code then allows connecting them to the respective district they are located in. There is at least one preschool in 40 of the 45 districts whereby most neighborhoods contain three to five settings.

3.2 Measures

3.2.1 Social composition of city districts

Data on characteristics that describe the level of deprivation of city districts are taken from the MOS. From these I chose indicators that are associated with educational disadvantages: poverty, family composition, and migration. I used three variables from the unemployment statistics – the percentage of unemployed, long-term unemployed and social welfare recipients – as proxies for poverty. Migration background was captured by two different concepts: The percentage of residing foreigners is based on information on citizenship. The share of the population (under the age of 18) with a migration background goes back to the resident's or the resident's parents' place of birth. Family composition is represented by information on single-parent households and families with at least three children.

All data are available for several years. Table 1 shows descriptive information on the indicators for 2008, but these do not differ substantially from the statistics in all other available years. For instance, the average proportion of unemployed is 2.81 % across all districts.[3] However, with a standard deviation (*SD*) of 1.27 we also observe differences between the districts with one neighborhood having the lowest proportion of 1.54 % up to 7.71 % in another. The other indicators show similar patterns. With a range from 11.38 % to 39.02 % and 9.30 % to 39.88 % the between district differences are even more pronounced in regard to the average proportion of single-parent households and migrants respectively. This variance points to segregation processes within Münster.

2 The data contain information on the number of months a child spent in preschool. This item is not included in the data before 2007.

3 The calculated proportions of unemployed are not directly comparable to the commonly used unemployment rates as they are not related to the working but total population in the districts.

Table 1: Descriptive statistics of the 2008 MOS data (in %)

Indicator	*M*	*SD*	Min	Max	Availability
Poverty					
Unemployed	2.81	1.27	1.54	7.71	2002–2008
Long-term unemployed	0.92	0.55	0.22	2.91	2002–2008
Welfare recipients	1.87	1.20	0.74	6.42	2006–2008
Family Composition					
Single-parent households	23.48	6.52	11.38	39.02	2005–2008
Families with at least three children	10.74	4.61	0.07	18.95	2005–2008
Migration					
Residing foreigners	7.42	3.11	3.47	15.80	2002–2008
Population with migration background	16.77	6.61	9.30	39.88	2006–2008
Population under 18 with migration background	2.85	1.80	0.50	8.60	2006–2008

Note. M = Mean; *SD* = Standard Deviation; Min = Minimum; Max = Maximum

A closer look on the 45 administrative units reveals that five districts have above average values in all indicators – often also the highest values overall – and thereby show a high concentration of social and ethnic disadvantages. Eight additional districts are above average in all three dimensions (poverty, family composition, and migration) whilst not in all indicators within these dimensions. Consequently, the MOS data potentially qualify to discriminate between different needs levels of preschools provided that the variation in the settings' needs levels follows the same structure.

3.2.2 Social composition of early childhood settings

Information on preschool composition is taken from the SEE which is obligatory for all children and used to diagnose their school readiness. Again, the selection of variables is informed by the debate on risk factors that are linked to educational disadvantages. Besides indicators whose associations to school success are well established in education research such as special education needs, the need for language promotion, migration background, family support, and family composition, the SEE provides additional information on variables which are discussed in neighboring disciplines (e.g., health sciences). Here, research shows that overweight or premature birth as well as incomplete preventive examinations impede a child's development (Friese, Dudenhausen, Kirschner, Schäfer, & Elkeles, 2003; Huffman, Mehlinger, & Kerivan, 2001; Künster et al., 2011; Schlack, 2008). At the time of a child's school entry examination, data in regard to these risk factors are gathered by two professionals, i.e., a school physician and a medical assistant, according to a standardized assessment and documentation form which is accompanied by a com-

prehensive definition instrument to ensure comparability. Missing data (between 0.8 % and 13.6 %) were imputed by multiple imputations. As research indicates that the negative effect of being disadvantaged increases as risk factors accumulate (Garbarino & Ganzel, 2000; Sameroff & Fiese, 2000), I additionally computed the variable 'children with cumulative risk' when at least three of the above-mentioned indicators applied to an individual child.

Table 2 gives an overview over the SEE variables used in this study and also displays descriptive statistics for the 2008/09 data. While the mean proportion of disadvantaged children is basically the same on setting and district level for all indicators, we observe pronounced differences in their spread. In six out of the ten indicators the proportion of disadvantaged children varies between zero and more than 85.00 % in preschools. The differences between neighborhoods are smaller in all observed variables and reach 58 percentage points at the most.

The reader should bear in mind that some of the variables are sensitive to the time point of data collection. The school entry examination takes place at the end of the preschool period, and educational needs that have already been addressed successfully are not measurable anymore. This mostly applies to the variables that are categorized as 'diagnosed educational and developmental needs', whereas it is reasonable that parental support is quite stable over time. This, however, does not affect time-invariant 'fixed markers'.

3.3 Analysis plan

The funding of settings based on district level information assumes that all settings within a district are equal or at least sufficiently similar in their resource needs. The research question of the study is whether the data from MOS can be used to finance early childhood education settings according to their need as measured by data taken from the SEE. Two aspects could limit the viability of the MOS data. First, the available district level measures do not adequately capture children's educational needs (*validity hypothesis*). Second, segregation processes within or across neighborhoods lead to between setting variation within districts, i.e., some settings are disproportionally attended by at-risk children while others are composed of rather privileged children (*segregation hypothesis*). In order to test these hypotheses, I employ data on different need indicators on both levels and analyze their correlation in a multi-step procedure (see Figure 2).

Table 2: Descriptive statistics of the 2008/09 SEU data (in %)

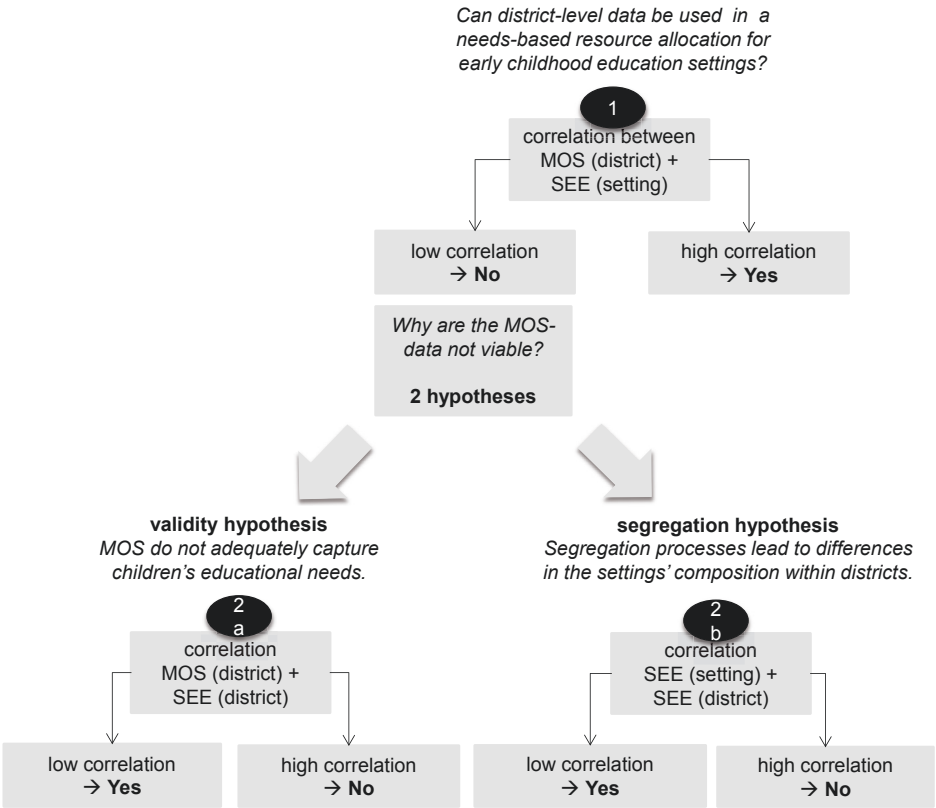
Indicator	Definition	*M*		Min–Max	
		SL[a]	DL[b]	SL[a]	DL[b]
Diagnosed educational and developmental needs					
Children with special educational needs	Need of physiotherapy, occupational therapy, speech therapy, logotherapy, early intervention, psychiatric or psychological support etc.	41.87	45.52	00.00–100.00	20.00–68.60
Children with migration background in need of language promotion	The child's articulateness in the German language	13.66	13.49	00.00–88.00	00.00–45.50
Overweight children	10 % of the heaviest children according to the Body Mass Index (BMI)	10.63	10.40	00.00–42.86	00.00–20.88
Parental support					
Children without parental support in swimming, sports or music	The child cannot swim/has not received musical training/is not regularly engaged in sports	21.08	20.17	00.00–95.00	00.00–57.41
Children without full preventive examination	Less than eight out of nine possible preventive examinations	9.03	9.51	00.00–44.00	00.00–28.57
Fixed markers					
Children from single-parent households	Only one adults living in the household	13.82	14.16	00.00–50.00	00.00–33.33
Children from families with at least three children	Number of children living in the household	28.39	25.56	00.00–85.00	00.00–49.33
Children with migration background	At least one parent reports to have a non-German background	33.11	34.29	00.00–100.00	16.30–74.77
Premature infants	Children born before the 37th pregnancy week	12.96	12.03	00.00–50.00	00.00–21.55
Children with cumulative risk	At least 3 indicators apply to the individual child	14.47	13.10	00.00–95.00	00.00–44.84

Note. M = Mean; Min–Max = Spread (Minimum–Maximum); SL = Setting Level; DL = District Level
[a]Data are aggregated on setting level. [b]Data are aggregated on district level.

In a first step I correlate the MOS data on district level with the SEE data on setting level (SEE_s) to answer the main research question of this study. High correlations indicate that MOS indicators can be used in needs-based resource allocation. Low correlations, on the contrary, mean that MOS data are not viable. In case of the latter, additional analyses are conducted for a better understanding of the reasons why MOS data cannot capture preschool settings' needs adequately. The validity hypothesis and the segregation hypothesis express two possible explanations for low correlations. The validity hypothesis is tested by aggregating the SEE

data on district level (SEE_d) and correlating them to the MOS data. Low correlations between both district-level datasets suggest that there is a validity problem; the MOS indicators do not capture children's educational needs adequately. High correlations, however, rule out the validity hypothesis. Observing high correlations between MOS and SEE_d on the one hand and low correlations between MOS and SEE_s on the other hand points to between setting variation within a district and, hence, an unequal distribution of at-risk children resulting in rather advantaged and disadvantaged compositions of preschools within a neighborhood (i.e., segregation). The segregation hypothesis is further tested by combining setting level SEE data (SEE_s) with district level SEE data (SEE_d). Here, low correlations cannot be accounted for by validity problems and rather speak for segregation processes.

Figure 2: Multi-step procedure of the correlation analyses



A correlation coefficient of r = .70 indicates the threshold for low, respectively high, correlations. This is motivated by the conviction that at least about 50 % of the differences in the settings' needs should be explained by their location if this information is to be used in a needs-based financing mechanism.

It has to be considered that while I can draw on the same needs factors in the last step of the analysis and correlate identical indicators, this is not possible when MOS and SEE data are combined. In those instances three different combination strategies are employed. First, indicators that represent similar constructs are correlated, such as the proportion of single-parent households in the districts on the one hand and the proportion of children from single-parent families in the preschool setting on the other hand. This is not only possible for family composition but also for migration indicators. Second, I focus on the risk-factor of poverty and examine the relationship between the MOS data on unemployment with all SEE needs indictors. Third, I analyze the correlation between all MOS indicators and the SEE factor of cumulative risk. Only data that are available for the same year in both datasets are combined.

4. Results

Table 3 summarizes the results of all analyses between the MOS and SEE data (step one and two of the multi-step analysis plan). First, results are presented for the analyses between the district level MOS data and the setting level SEE data (SEE_s). Overall, the strength of the relationship between the two sets of indicators varies with mostly significant correlations between $r = .20$ and $r = .64$ ($p < .01$). Whereas the correlations between the indicators of family composition are rather small ($r = .26$ to $r = .38$), the relationship is stronger between variables that refer to a migration background ($r = .48$ to $r = .62$). We observe quite similar correlations ($r = .49$ to $r = .64$) between the proportion of children with cumulative risk in the settings and all MOS district-level data except for household composition variables. The districts' unemployment statistics correlate strongest with the settings' proportion of children with migration background ($r = .43$ to $r = .56$), children with migration background in need of language promotion ($r = .24$ to $r = .56$), and children without parental support in swimming, sports or music ($r = .47$ to $r = .60$).

Although these results show that the indicators of the MOS data predict the preschool settings' needs to varying degrees, all in all the analyses reveal no sufficient correlation to justify a resource allocation by statistical data on district level. No single correlation reaches the predetermined threshold of $r = .70$.

Table 3: Results of the correlation analyses between the two data sources of MOS and SEE

MOS (in %)	SEE (in %)	*r* (Min–Max)		Years (*n*)[a]
		D–S[b]	D–D[c]	
Migration background				
Residing foreigners	Children with migration background	.49**-.57**	.69**-.78**	03/04 –08/09 (6)
Residing foreigners	Children with migration background in need of language promotion	.48**-.56**	.45**-.69**	03/04 –08/09 (6)
Population with migration background	Children with migration background	.54**-.56**	.81**-.88**	06/07 –08/09 (3)
Population with migration background	Children with migration background in need of language promotion	.59**-.62**	.74**-.88**	06/07 –08/09 (3)
Population under 18 with migration background	Children with migration background	.49**-.52**	.61**-.64**	06/07 –08/09 (3)
Population under 18 with migration background	Children with migration background in need of language promotion	.59**-.62**	.70**-.78**	06/07 –08/09 (3)
Family composition				
Single-parent households	Children from single-parent households	.26**-.33**	.31*- .70**	05/06 – 08/09 (4)
Families with at least three children	Children from families with at least three children	.26**-.38**	.58**-.80**	05/06 – 08/09 (4)
Poverty				
Unemployed / long-term unemployed welfare recipients	Children with special educational needs	-.15-.35**	-.19-.40**	03/04 – 08/09 (6) 06/07 – 08/09 (3)
Unemployed / long-term unemployed welfare recipients	Children with migration background in need of language promotion	.24**-.56**	.36**-.74**	03/04 – 08/09 (6) 06/07 – 08/09 (3)
Unemployed / long-term unemployed welfare recipients	Overweight children	.20**-.40**	.18-.44**	03/04 – 08/09 (6) 06/07 – 08/09 (3)
Unemployed / long-term unemployed welfare recipients	Children without parental support in swimming, sports or music	.47**-.60**	.69**-.89**	03/04 – 08/09 (6) 06/07 – 08/09 (3)
Unemployed / long-term unemployed welfare recipients	Children without full preventive examination	.38**-.52**	.19-.76**	03/04 – 08/09 (6) 06/07 – 08/09 (3)
Unemployed / long-term unemployed welfare recipients	Children with migration background	.43**-.56**	.50**-.82**	03/04 – 08/09 (6) 06/07 – 08/09 (3)
Unemployed / long-term unemployed welfare recipients	Children from single-parent households	.25**-.35**	.27-.53**	03/04 – 08/09 (6) 06/07 – 08/09 (3)
Unemployed / long-term unemployed welfare recipients	Children from families with at least three children	.25**-.36**	.20-.40**	03/04 – 08/09 (6) 06/07 – 08/09 (3)
Unemployed / long-term unemployed welfare recipients	Premature infants	.03-.14	-.22-.14	03/04 – 08/09 (6) 06/07 – 08/09 (3)

(continued)

Table 3: Results of the correlation analyses between the two data sources of MOS and SEE (continued)

MOS (in %)	SEE (in %)	*r* (Min–Max)		Years (*n*)[a]
		D–S[b]	D–D[c]	
	Cumulative risk			
Unemployed	Children with cumulative risk	.54**-.63**	.59**-.84**	03/04 – 08/09 (6)
Long-term unemployed	Children with cumulative risk	.52**-.63**	.71**-.86**	03/04 – 08/09 (6)
Welfare recipients	Children with cumulative risk	.56**-.64**	.81**-.85**	06/07 – 08/09 (3)
Single-parent households	Children with cumulative risk	.06-.24**	.18-.27	05/06 – 08/09 (4)
Families with at least three children	Children with cumulative risk	.33**-.39**	.21-.45**	05/06 – 08/09 (4)
Residing foreigners	Children with cumulative risk	.49**-.56**	.56**-.66**	03/04 – 08/09 (6)
Population with migration background	Children with cumulative risk	.58**-.62**	.83**-.84**	06/07 – 08/09 (3)
Population under 18 with migration background	Children with cumulative risk	.57**-.59**	.74**-.79**	06/07 –08/09 (3)

Note. *r* = Pearson's r; Min = Minimum; Max = Maximum; *n* = number of available years; D–S = District–Setting; D–D = District–District.
[a]Correlations are calculated for every year MOS and SEE contain data; *n* = number of years correlations were calculated. [b]Correlations between district level MOS data and setting level SEE data. [c]Correlations between district level MOS data and district level SEE data.
$^{*}p < .05$. $^{**}p < .01$.

Even if there is a relationship of $r = .60$, the need factors of MOS and SEE_s only share one third of their variance. Hence, two thirds of the variance remains unexplained if the settings' need is indicated by the available regional data.

In order to test the validity hypothesis – that is to explore whether the data of different sources encompass similar or dissimilar constructs – I aggregated the SEE data on district level (SEE_d) and analyzed their relationship to the MOS data. With high correlations between both data sets on district level ($r > .70$) the validity hypothesis is not tenable whereas low correlations ($r < .70$) indicate validity problems. All in all, we get mixed results. Some variables of the MOS data such as the proportion of single-parent households seem to be unable to capture the settings' needs adequately. Other MOS variables seem to be quite adequate proxies. Data from the unemployment statistics or migration background variables, for instance, highly correlate with the proportion of children with migration background in need of language promotion, the proportion of children without parental support in swimming, sports or music, and the proportion of children with cumulative risk ($r = .69$ to $r = .89$; $p < .01$).

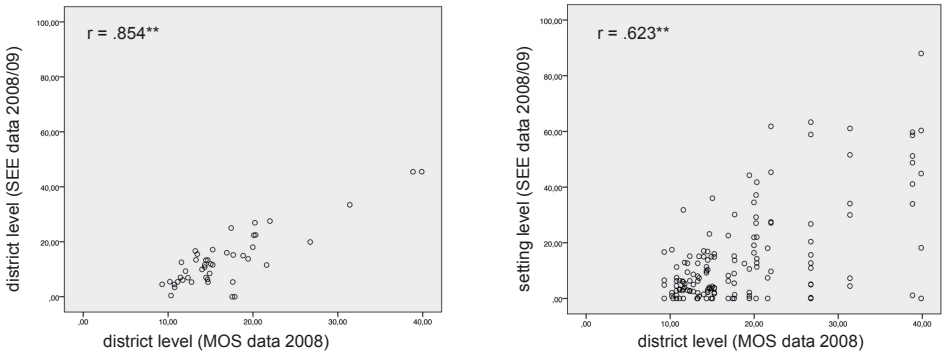
As the validity hypothesis has to be rejected for at least some of the MOS indicators, I will now turn to investigating the possibility of segregation processes. If all settings within a district were equal or at least similar in their needs, the correlations between MOS and SEE_d on the one hand and MOS and SEE_s on the other hand would be (nearly) the same – given the result that there are no validity prob-

lems. The fact that the correlations between the variables are substantially higher when aggregated on district level compared to setting level can be explained by between SEE_s variation within a district.

Figure 3 shows this exemplary for the relationship between the proportion of children with migration background in need of language promotion (SEE) and the proportion of population with migration background (MOS) in 2008. The first scatter plot graphically reveals the high and linear correlation of $r = .85$ ($p < .01$) between both variables on district level. The relationship between the respective data on district and setting level as it is displayed in the second scatter plot is much smaller ($r = .62$; $p < .01$). This is due to differences between settings within a district, and this variance becomes greater as the proportion of migrants in the districts increases.

For instance, in the most advantaged district only 9.3 % of the population has a migration background. Five preschools are located in this district, and their respective proportion of children with a migration background in need of language promotion varies between zero (two settings) and 16.67 %. In contrast, when the population with migration background reaches a proportion of 39.88 % in the most disadvantaged district, which also contains five settings, we observe differences between zero and 88 %. Thus, differences between the settings' composition in regard to the proportion of at-risk children seem to increase with the neighborhoods' level of deprivation.

Figure 3: Relationship between setting and district composition



Note. The scatterplots show the correlation between the proportion of children with migration background in need of language promotion in the year 2008/09 according to the SEE data (y-axis) and the proportion of the population with migration background in 2008 according to the MOS data (x-axis); left hand side: SEE data are aggregated on district level; right hand side: SEE data are aggregated on setting level.
$^{**}p < .01$.

In order to test the segregation hypothesis further, the relationship between district level and setting level information within the SEE data only (SEE_d and SEE_s) is explored. The results of these analyses (see Table 4) show the strongest relationship ($r = .57$ to $r = .69$; $p < .01$) for those variables that also highly correlate

to MOS poverty and migration indicators on district level: the proportion of children with migration background, the proportion of children with migration background in need of language promotion, the proportion of children without parental support in swimming, sports or music, and the proportion of children with cumulative risk.

Again, a substantial portion of the variance between the settings (SEE_s) cannot be explained by the district they are located in (SEE_d). This applies particularly to variables with correlations between r = .30 and r = .50. Thus, a needs-based resource allocation that is geared to a preschool setting's neighborhood instead of the setting itself cannot sufficiently account for the setting's needs. As the SEE data show that 69.1 % of the children attend a preschool in the neighborhood of their home address, while 30.9 % cross district boarders, the unequal distribution of at-risk children to the settings can be due to segregation processes within- as well as across-district mobility.

Table 4: Results of the correlation analyses between setting level and district level SEE data

Needs factor (in %)	r (Min–Max)[a]
Children with cumulative risk	.59**-.69**
Children without parental support in swimming, sports or music	.58**-.66**
Children with migration background in need of language promotion	.57**-.64**
Children with migration background	.57**-.60**
Children with special educational needs	.47**-.58**
Overweight children	.47**-.58**
Children without full preventive examination	.35**-.57**
Children from families with at least three children	.32**-.53**
Children from single-parent households	.30**-.44**
Premature infants	.13-.27**

Note. r = Pearson's r; Min = Minimum; Max = Maximum.
[a]Correlations are calculated for all years SEE data are available (2004/05 to 2008/09); the lowest and highest value are presented in the table.
**$p < .01$.

5. Discussion

The study contributes to research that tries to identify indicators for a needs-based resource allocation in early childhood education that are objective, easily at hand, and non-manipulable. It also raises awareness that funding based on district level data might not be sufficiently targeted to reach the settings according to their need. The results of the correlation analyses show that some of the indicators from MOS do not adequately capture the settings' needs as measured by the SEE. More importantly, even when no such validity problems apply, segregation processes lead to pronounced differences in the proportions of at-risk children of settings within a

district. Consequently, if additional resources are allocated to settings in deprived areas, they are not employed economically as providers might benefit who are not in need. The other way around, settings with a high proportion of disadvantaged children that are located in less deprived districts are not supported adequately.

Before elaborating on the educational significance of these findings from a more substantial perspective, possible methodological weaknesses of the analyses are discussed in order to address the question of how trustworthy the results of this study are. First of all, one could be nervous about the external validity of the study findings. Results from analyses that are based on data gathered and explored in a local context are hardly generalizable. However, not only do studies in other regions come to similar conclusions (Becker, 2010; Hilgers & Strehmel, 2008), but the findings are also in line with other national and international education research that points to the relevance of school choice and selection mechanisms for segregation processes (e.g., Kristen, 2008; Mickelson, Bottia, & Southworth, 2008). Therefore, it is likely that the results of this study will be replicated elsewhere.

Further concerns might be expressed regarding the use of the school entry examination data as a proxy for the settings' resource need. While the data aggregation of three cohorts of children seems to be justified and provides a good approximation of the preschools' actual social composition, it cannot be denied that the time point of the data collection is a relevant issue. The school entry examination takes place when children are about to enter school and have already spent some time in preschool. Thus, existing educational needs of children during their early years might not to be measurable anymore as they have been reduced due to considerable pedagogical efforts in early education. In such cases, resource needs did exist but are not detectable anymore at the time of school entry. However, the school entry examination data also contain time-invariant fixed risk factors that are not amenable to influence and remain stable over time. As there are no substantial differences in the analysis results subject to different kinds of indicators, the findings of the study seem to be robust.

This study gives interesting insights in financing-related processes in the field of early childhood education. In terms of a needs-based resource allocation the findings suggest that it is not sufficient to improve district level social accounting by gathering data that are more child-focused or education-related. Rather, the financing of early childhood education requires data on setting or individual level in order to be target-oriented. We have to keep in mind, however, that even if we are able to identify suitable needs indicators, this does not automatically lead to more educational equality. Research is still inconclusive when it comes to questions to what extent, why, and when resources do matter concerning educational outcomes (World Bank, 2013). Funding is a rather indirect control mechanism within educational governance, and little is known about the impacts of needs-based resource allocation on educational equality, especially in the field of early childhood education (Levin & Schwartz, 2007).

Finally, the segregation processes that can be observed do not only have consequences for fiscal planning but also relate to broader issues of educational equal-

ity. If segregation leads to socially and ethnically homogenous learning environments in preschools, this means less educational opportunities for those individuals who attend settings with a high proportion of disadvantaged children (Sylva et al., 2003). While the USA have many years of experiences with approaches like bussing, quotas or magnet schools that intend to mitigate racial or social segregation in the field of education (e.g., Patterson, Niles, Carson, & Kelley, 2008), such desegregation strategies for schools have only recently been discussed in Europe and are also highly controversial (European Commission, 2008; Heckmann, 2008). Additionally, the mechanisms leading to segregation might differ not only from country to country but also between the school and preschool sector. While researchers argue that both parental choice and institutional selection mechanisms are causes for segregation in early childhood education in Germany (Becker, 2010; Hüsken, 2011), there is hardly any study that has addressed these aspects comprehensively. More research is needed to understand such processes in order to find approaches that are able to provide disadvantaged children with a more diverse and, thereby, more beneficial social environment in early childhood education settings.

References

Agyemang, G. (2008). *Accounting for needs? Formula funding in the UK school sector*. School of Management, Royal Holloway University of London. Working Paper Series SoMWP-08-09.

Barnett, S. W. (2010). Universal and targeted approaches to preschool education in the United States. *International Journal of Child Care and Education Policy, 4*(1), 1–12.

Barnett, S. W., Brown, K., & Shore, R. (2004). The universal vs. targeted debate: Should the United States have preschool for all? *NIEER Policy Brief No. 6*. Retrieved from http://nieer.org/resources/policybriefs/6.pdf

Becker, B. (2010). Ethnische Unterschiede in der Kindergartenselektion: Die Wahl von unterschiedlich stark segregierten Kindergärten in deutschen und türkischen Familien. (Ethnic differences in kindergarten selection. Choice of different strongly segregated kindergartens in German and Turkish families.) In B. Becker & D. Reimer (Eds.), *Vom Kindergarten bis zur Hochschule: Die Generierung von ethnischen und sozialen Disparitäten in der Bildungsbiographie* (pp. 17–47). Wiesbaden: VS.

Bennett, J. (2012). *ECEC for children from disadvantaged backgrounds: Findings from a European literature review and two case studies. Final Report*. Commissioned by the European Commission.

Betts, J. R., & Roemer, J. E. (2007). Equalizing opportunity for racial and socioeconomic groups in the United States through educational-finance reform. In L. Woessmann & P. E. Peterson (Eds.), *Schools and the Equal Opportunity Problem* (pp. 209–237). Cambridge: MIT Press.

Boocock, S. S. (2003). Lessons from Europe: European preschools revisited in a global age. In A. J. Reynolds, M. C. Wang, & H. J. Walberg (Eds.), *Early childhood programs for a new century* (pp. 299–328). Washington, DC: CWLA Press.

BMBF – Bundesministerium für Bildung und Forschung. (Ed.). (2010). *Zur Konstruktion von Sozialindizes: Ein Beitrag zur Analyse sozialräumlicher Benach-*

teiligung von Schulen als Voraussetzung für qualitative Schulentwicklung (Bildungsforschung, Vol. 31). Bonn, Germany.

Bushouse, B. K. (2009). *Universal preschool. Policy change, stability, and the Pew Charitable Trusts*. Albany, NY: SUNY Press.

Chambers, J. G., Levin, J. D., & DeLancey, D. (2006). *Efficiency and adequacy in California school finance: A professional judgment approach*. Retrieved from http://www.air.org /expertise/index/?fa=viewContent&content_id=632

Chambers, J. G., Parrish, T. B., Levin, J. D., Smith, J. R., Guthrie, J. W., Seder, R. C., & Taylor, L. (2004). *The New York adequacy study: Determining the cost of providing all children in New York an adequate education*. Volume 1 – Final Report. Retrieved from http://www.air.org/files/NYAdequacyReportVOLUMEI1.pdf

Department for Children, Schools and Families. (2009). *Implementing the Early Years Single Funding Formula. Practice guidance July 2009*. Retrieved from http://www.dcsf. gov.uk/everychildmatters/resources-and-practice/IG00611/

Edwards, P., Ezzamel, M., Robson, K., & Taylor, M. (1996). Comprehensive and incremental budgeting in education. The construction and management of formula funding in three English local education authorities. *Accounting, Auditing & Accountability Journal, 9*, 4–37.

European Commission. (2008). *Migration & mobility: Challenges and opportunities for EU education systems* (Green Paper). Brussels, Belgium.

Friese, K., Dudenhausen, J. W., Kirschner, W., Schäfer, A., & Elkeles, T. (2003). Risk factors of premature birth and their significance for prevention and health promotion – An analysis based on the BabyCare Programme. *Gesundheitswesen, 65* (08/09), 477–485.

Fuller, B. (2007). *Standardized childhood. The political and cultural struggle over early education*. Standford, CA: Standford University Press.

Garbarino, J., & Ganzel, B. (2000). The human ecology of early risk. In J. P. Shonkoff & S. J. Meisels (Eds.), *Handbook of Early Childhood Intervention* (pp. 76–93). New York, NY: Cambridge University Press.

Glennerster, H., Hills, J., & Travers, T. (2000). *Paying for health, education, and housing. How does the centre pull the purse strings?* Oxford, UK: Oxford University Press.

Heckmann, F. (2008). *Education and the integration of migrants challenges for European education systems arising from immigration and strategies for the successful integration of migrant children in European schools and societies* (NESSE Analytical Report 1 for EU Commission DG Education and Culture). Bamberg, Germany: European Forum for Migration Studies.

Hilgers, A., & Strehmel, P. (2008). *Bildungschancen und Bildungsqualität im Kita-Gutscheinsystem*. Presentation at the Conference "5 Jahre Kita-Gutscheinsystem. Bilanz und Perspektiven" at the HAW in Hamburg, Germany, 30. to 31.10.2008.

Hüsken, K. (2011). *Kita vor Ort: Betreuungsatlas auf Ebene der Jugendamtsbezirke 2010*. München, Dortmund: DJI. Retrieved from: http://www.dji.de/cgi-bin/projekte/output.php?projekt =1007&Jump1=LINKS&Jump2=6

Huffman, L. C., Mehlinger, S. L, & Kerivan, A. S. (2000). Risk factors for academic and behavioral problems at the beginning of school. In L. C. Huffman, S. L. Mehlinger, A. S. Kerivan, D. A. Cavanaugh, J. Lippitt, & O. Moyo (Eds.), *Off to a good start: Research on risk factors for early school problems and selected federal policies affecting children's social and emotional development and their readiness for school* (pp. 16–105). Washington, DC: Department of Health and Human Services.

Jimenez-Castellanos, O., & Topper, A. M. (2012). The cost of providing an adequate education to English language learners: A review of the literature. *Review of Educational Research, 82*(2), 179–232.

Karoly, L. A., Kilburn, M. R., & Cannon, J. S. (2005). *Early childhood interventions: Proven results, future promise*. Santa Monica, CA: Rand Corporation.

Kristen, C. (2008). Primary school choice and ethnic school segregation in German elementary schools. *European Sociological Review, 24*(4), 495–511.

Künster, A. K., Wucher, A., Thurn, L., Kindler, H., Fischer, D., & Ziegenhain, U. (2011). Epidemiology of risks and child maltreatment in early childhood: A pilot study. *Praxis der Kinderpsychologie und Kinderpsychiatrie, 60*(3), 206–223.

Levacic, R., & Downs, P. (2004). *Formula funding of schools, decentralization, and corruption: A comparative analysis*. Paris, France: UNESCO, IIEP.

Levin, H., & McEwan, P. (2001). *Cost-effectiveness analysis: Methods and applications*. Thousand Oaks, CA: Sage Publications.

Levin, H. M., & Schwartz, H. L. (2007). *What is the cost of a preschool program?* Paper presented at the AEFA 2007 Annual Conference, Baltimore, Maryland. Retrieved from: http://cbcse.org/publications/

Mayston, D. J. (1998). Devolved budgeting, formula funding and equity. *Management Accounting Research, 9*, 37–54.

Mickelson, R. A., Bottia, M., & Southworth, S. (2008). School choice and segregation by race, class, and achievement. Retrieved from: http://epsl.asu.edu/epru/documents /EPSL-0803-260-EPRU.pdf

Olsen, D. A. (2003). Understanding the promise of universal preschool. In A. J. Reynolds, M. C. Wang, & H. J. Walberg (Eds.), *Early childhood programs for a new century* (pp. 329–352). Washington, DC: CWLA Press.

Patterson, J. A., Niles, R., Carson, C., & Kelley, W. L. (2008). The consequences of school desegregation in a Kansas Town 50 years after brown. *Urban Review, 40*, 76–95.

Roemer, J. E. (1998). *Equality of opportunity*. Cambridge, MA: Harvard University Press.

Ross, K. N., & Levacic, R. (1999). *Needs-based resource allocation in education via formula funding of schools*. Paris, France: International Institute for Educational Planning, United Nations Educational, Scientific and Cultural Organization.

Sameroff, A. J., & Fiese, B. H. (2000). Transactional regulation: The developmental ecology of early intervention. In J. P. Shonkoff & S. J. Meisels (Eds.), *Handbook of early childhood intervention* (pp. 135–159). New York, NY: Cambridge University Press.

Schlack, H. G. (2008). How (un)healthy are children in Germany? Facts, interpretations, and tasks. *Frühförderung interdisziplinär, 27*(4), 147–154.

Schweinhart, L. J. (2003). The three types of early childhood programs in the United States. In A. J. Reynolds, M. C. Wang, & H. J. Walberg (Eds.), *Early childhood programs for a new century* (pp. 241–254). Washington, DC: CWLA Press.

Smith, P. C. (2003). Formula funding of public services: An economic analysis. *Oxford Review of Economic Policy, 19*(2), 301–322.

Smith, P. C., Rice, N., & Carr-Hill, R. (2001). Capitation funding in the public sector. *Journal of the Royal Statistical Society, Series A, 164*(2), 217–257.

Sylva, K., Melhuish, E., Sammons, P., Siraj-Blatchford, I., Taggart, B., & Elliot, K. (2003). *The effective provision of pre-school education (EPPE) project: Findings from the pre-school period*. DfES Research Brief No. 15-03.

UNESCO. (1997). *ISCED 1997: International Standard Classification of Education*. UNESCO: Institute for Statistics.

Woessmann, L. (2008). Education finance in Germany from a lifecycle perspective: An efficiency-equity trade-off? *Zeitschrift für Erziehungswissenschaft, 11*(2), 214–233.

World Bank. (2013). *What matters most for school finance: A framework paper* (SABER working Paper Series No. 2). Retrieved from: http://documents.worldbank.org/curated /en/2013/04/18069765/matters-most-school-finance-framework -paper

Zigler, E., Gilliam, W. S., & Jones, S. M. (2006). *A vision for universal preschool education*. Cambridge, UK: Cambridge University Press.

Zimmer-Hegemann, R., Strohmeier, K.-P., Meyer, C., Stößer, K., Kersting, V., & Heidbrink, I. (2006). *Sozialraumanalyse: Soziale, ethnische und demographische Segregation in den Nordrhein-westfälischen Städten. (Analysis of regional data: Social, ethnic, and demographic segregation in North Rhine-Westphalian cities.)* Gutachten im Auftrag der Enquetekommission „Zukunft der Städte in NRW“ des Landtags Nordrhein-Westfalen (ILS NRW Schriften Nr. 201). Institut für Landes- und Stadtentwicklungsforschung und Bauwesen des Landes Nordrhein-Westfalen.