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ORIGINAL PAPER

Towards a multidimensional poverty index for Germany

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Abstract This paper proposes a more comprehensive multidimensional poverty index for an advanced economy like Germany. Drawing on the capability approach as conceptual framework, I apply the Alkire–Foster method to the German context. Special attention is paid to the conceptual integration. Specifically, I argue for including material deprivation and employment as important dimensions, but against using an additional lack-of-income indicator. The results are consistent with previous findings and also offer new insights. In particular, I find specific poverty profiles (e.g., for the elderly), but also that gaps in poverty between subpopulations change over time. Importantly, the results suggest that genuine multidimensional measures add unique insights, which neither a single indicator, nor a dashboard approach can offer. Finally, the analysis reveals multidimensional and income-poverty measures to disagree on who is poor. The subsequent analysis of this mismatch lends empirical support to abandon a lack-of-income dimension.

Keywords Multidimensional poverty · Capability approach · Counting approach · Alkire–Foster method · Capability deprivation · SOEP

JEL Classification I32 · D63 · H1

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1 Introduction

1.1 Background

Poverty in advanced economies is returning to the agenda of both policy makers and academics. Most countries of the European Union, for instance, have adopted national action plans for social inclusion after the Nice summit in 2001 (Atkinson et al. 2002). Alternative approaches to measure human well-being more accurately also receive growing attention (e.g., OECD 2011). Indeed, the main concern of Stiglitz et al. (2009) is to close the gap between what current official statistics on social progress suggest, and what people in fact experience. Likewise, by tracing more than a dozen 'core indicators', poverty reports in Germany seek to go beyond what conventional income-poverty measures can capture.

Additionally, significant improvements in the methodology of multidimensional measurements have been made as well (e.g., Tsui 2002; Bourguignon and Chakravarty 2003; Alkire and Foster 2011). So far, these measures have been systematically employed to analyze poverty in the developing world; see in particular Alkire and Santos (2014) and UNDP (2011). However, applying these techniques to advanced economies requires appropriately adapted specifications and operationalizations, such as choosing the relevant dimensions, appropriate indicators, and reasonable cutoffs. Moreover, these choices are also contingent upon the concrete purpose of the poverty measure: Is the task to identify general trends across countries and to assess countries' relative performance in fighting poverty? Or is there a need to evaluate policy measures and to examine poverty dynamics in one specific country? As these overall objectives crucially affect the response to many of the arising trade-offs during the specification, their explication is imperative. The present paper seeks to complement Germany's official reports on poverty and wealth (RPW) with a comprehensive summary measure that also takes account of the joint distribution of deprivations. The importance of "the joint distribution" has been emphasized repeatedly (Wolff and de-Shalit 2007; Stiglitz et al. 2009).

1.2 Procedure

A clear conceptual framework is central to any measurement exercise, as it details the construct to be measured. To this end I adopt the capability approach (CA), as essentially developed by Sen (1985, 1992, 1999b). Dimensions are understood as functionings, which in turn constitute human well-being. This inherently multidimensional notion of well-being offers a comprehensive and coherent account of deprivations. Moreover, poverty is understood as capability deprivation, i.e. in addition to low achievements in dimensions, poor individuals also lack the freedom to fare better (Sen 1992, ch. 7). Finally, inevitable value judgments (e.g., choosing dimensions) need to be revealed and related to the relevant public debate (Sen 1999b, ch. 6).

Technically, I apply the dual cutoff counting approach suggested by Alkire and Foster (2011). The Alkire–Foster method (AFM) fulfills several desirable axioms that

allow a sensible analysis (e.g., numerous decompositions). Changes in the index, for instance, can be traced back to changes in the indicators. Further advantages follow from having a second, the so-called poverty cutoff. First, the adjusted headcount ratio of Alkire and Foster (2011) can thereby be related to capability poverty, through being a measure of unfreedom (Alkire et al. 2015, ch. 6.1). This is relevant for the present case, since the latest RPW indeed notes difficulties in measuring capability deprivations (Bundesregierung 2013, pp. 23–24). Second, the poverty cutoff also allows to handle a larger number of deprivation indicators, where union and intersection approach produce impracticable results. This is important for the present case as well, since the German RPW already suggest 17 "core indicators". Third, the poverty cutoff allows to distinguish deprivation from poverty, where individuals suffer from *multiple* deprivation. This aspect has not only normative force, but also offers novel insights on dynamics, since the poor are then a specific subset of the deprived (Suppa 2017). Importantly, as an "open-source technology", the AFM reveals rather than buries the value judgments and thereby allows for a constructive exchange with the public debate.[1] The empirical analysis uses data of the German Socio-Economic Panel (SOEP). The poverty measure is calculated for three points in time, which allows a particular comprehensive specification.

1.3 Previous research

Previous attempts applying the AFM to advanced economies include Whelan et al. (2014) and Alkire and Apablaza (2016). Both studies focus on cross-country comparisons using EU-SILC data where, however, most indicators are located in resource space. Moreover, Alkire and Apablaza (2016, p. 6) note that their measure is mostly illustrative, for reasons of data availability and comparability. Using German SOEP data, Busch and Peichl (2010) apply the AFM (among other methods), whereas Nowak and Scheicher (2016) implement a modified version of the AFM. Both studies are, however, only weakly integrated into a conceptual framework. Also using SOEP data, Rippin (2016) employs a correlation-sensitive poverty index, which also reflects inequality among the poor. Alkire and Foster (2016), however, argue that no measure can be both sensitive to inequality (understood as dimensional transfer) and simultaneously satisfy dimensional breakdown and subgroup decomposability. An important intricacy with the SOEP data is that not all questions are asked in every year in order to reduce the burden for the respondents. Hence a more frequent calculation of the poverty measure necessitates a narrower specification. While Busch and Peichl (2010) and Nowak and Scheicher (2016) base most of their analyses on annual data, Rippin (2016) opts for biannual calculation.[2] Moreover, virtually all of the previous studies include income as a dimension, although it is conceptually and empirically unclear whether

[1] Note, however, that some authors criticise multidimensional poverty measurement in general (Ravallion 2011) or specific aspects Silber (2011), whereas others have suggested different approaches (e.g., Datt 2013) which, however, usually adopt a union-approach for identification, see also Alkire et al. (2015) for an overview.

[2] Accordingly the chosen specification vary significantly: Busch and Peichl (2010) use only education, health, and income; Nowak and Scheicher (2016) use mostly five dimensions, however, with only 1

such an approach is justified. Thus, despite some attempts in this direction, more comprehensive and well-justified multidimensional poverty indexes for advanced economies are still lacking.

1.4 Contribution

The present paper complements the previous literature in two directions. Conceptually, I propose how to operationalize a multidimensional poverty index for advanced economies using the example of Germany. Focussing on a single country allows me to use the most comprehensive data available for that country. More specifically, I argue for including material deprivation and employment as important dimensions, as they contribute extra information on otherwise ignored functionings. In addition to education, health, and housing, I also propose an operationalization of social participation. However, I abandon a lack-of-income dimension for both conceptual and empirical grounds. Specifically, I show that income-poverty is largely captured by material deprivation indicators. Exploiting comprehensive wealth information, I also demonstrate that income inaccurately reflects material well-being for a significant share of the income-poor. The role of income in multidimensional poverty measures has not been systematically addressed so far.

Empirically, several results are shown to be consistent with earlier findings (e.g., migrants suffer more poverty), but also new insights ensue, such as a specific profile for old-age poverty. Over the decade under consideration, multidimensional poverty exhibits a hump shape and both employment and material deprivation indicators are shown to figure prominently in this development. Moreover, I find gaps in poverty between subgroups to change over time. East-Germany, for instance, registers first the higher increase but then experiences the smaller decrease in multidimensional poverty. In contrast, both gender and migrant gap in poverty are shrinking. Importantly, the results also suggest that genuine multidimensional measures may add unique insights, which neither a single indicator, nor a dashboard approach can offer. Both approaches ignore information of the joint distribution of deprivations. Finally, I also document multidimensional- and income-poverty measures to substantially disagree on who is poor. This contrast in targeting gives reason to expect different policy implications.

1.5 Outline

Section 2 briefly introduces the underlying methods; Sect. 3 presents both data and specification. Section 4 contains some empirical results, whereas Sect. 5 scrutinizes the role of income in multidimensional poverty. Finally, Sect. 6 offers some concluding remarks.

Footnote 2 continued
indicator per dimension. While Rippin (2016) expands the specification to six dimensions, with partly several indicators per dimensions, e.g, social participation still remains unconsidered.

2 Methodology

The Alkire–Foster method offers numerous benefits for the evaluation of both poverty-relevant developments and policy measures. The exposition here is restricted to those aspects used in the subsequent empirical analysis. Further aspects are found in Alkire and Foster (2011), Alkire et al. (2015).

2.1 Identification

The matrix y contains the available data, is of size $N \times D$, and describes for each individual the achievement in each dimension deemed relevant. Specifically, $y_{id} \geq 0$ represents the achievement of individual $i = 1, \ldots, N$ in dimension $d = 1, \ldots, D$. The row vector z, with $z_d > 0$, describes the deprivation cutoffs, i.e., the achievements necessary for not being considered as deprived in the respective dimension. Using this information, we obtain the deprivation vector c by counting individual deprivations, i.e., the column vector's elements are $c_i = \sum_{d=1}^{D} \mathbb{1}(y_{id} < z_d)$. Following Bourguignon and Chakravarty (2003), the discrimination between poor and non-poor individuals depends critically on dimensional achievements and the respective cutoffs. Thus identification can be described by a function $\rho(y_i, z)$. Several approaches have been suggested so far. While the union approach is characterized by $\rho(y_i, z) = \mathbb{1}(c_i \geq 1)$, the intersection approach requires $c_i = D$. The key idea of Alkire and Foster (2011) is to define $\rho_k(y_i, z) = \mathbb{1}(c_i \geq k)$ for $k \in [1, D]$. Since ρ_k depends on both the dimension-specific cutoffs z_j and the overall cutoff k, it is called the dual cutoff approach. The union and intersection approaches are included as special cases ($k = 1$ and $k = D$).

2.2 Aggregation

A simple form of aggregation is the calculation of the headcount ratio, which is defined as $H = q/N$, where $q = \sum_{i=1}^{N} \mathbb{1}(c_i > k)$ is the number of the poor. Additionally, to take account of the breadth of poverty we first censor the counting vector of deprivations for non-poor and define $c(k)$ with elements $c_i(k) = \mathbb{1}(c_i \geq k)c_i$ for all $i = 1, \ldots, N$. As $c_i(k)/D$ is the share of all possible deprivation suffered by i, $A = \sum_{i=1}^{N} c_i(k)/(qD)$ represents the average deprivation suffered by the poor, which is also called the intensity. Alkire and Foster (2011) then define the adjusted headcount ratio as $M_0 = \frac{1}{N}\sum_{i=1}^{N} c_i = HA$, which is sensitive to both changes in incidence and breadth of poverty. In principle other members of the FGT class of measures (see Foster et al. 1984) can be applied as well—their discussion is however beyond the scope of this paper.

2.3 Weights

So far we have assumed equal weights for all dimensions. To allow for different weights, we introduce a weighting vector w with $\sum_{d=1}^{D} w_d = 1$. Then the weighted deprivation count becomes $c_i = \sum_{D=1}^{D} w_d \mathbb{1}(y_{id} \leq z_d)$, and $M_0 = \frac{D}{N}\sum_{i=1}^{N} c_i(k)$.

2.4 Decompositions

The adjusted headcount M_0 and both its single components and its changes over time have been shown to be decomposable in numerous ways. For instance, the subgroup decomposition of M_0 means that the overall adjusted headcount ratio can be written as a population-weighted average of the subpopulation-specific adjusted headcount ratios. Formally,

$$M_0(y;z) = \sum_{g=1}^{G} \psi_g M_0(y_g;z), \tag{1}$$

where $g = 1, \ldots, G$ denotes a particular subpopulation with $\sum_g^G N_g = N$ and $\psi_g = \frac{N_g}{N}$. The adjusted headcount ratio can also be decomposed into the contributions of each dimension. First, let $h_d(k) = \frac{1}{N}\sum_{i=1}^{N} \mathbb{1}(c_i \geq k \wedge y_{id} \leq z_d)$ be the dimension-specific censored headcount, which allows us to rewrite the adjusted headcount as

$$M_0 = \sum_{d=1}^{D} \frac{w_d}{D} h_d(k). \tag{2}$$

Then, the contribution of dimension d to overall poverty is $\frac{w_d}{D}\frac{h_d(k)}{M_0}$. If data on more than one point of time is available, we also can calculate and decompose changes of aggregate measures. Often, however, the decomposition of changes relies on questionable assumptions (Alkire et al. 2015, ch. 9.2). In analysing the dimensions behind changes I, therefore, rely on censored and uncensored headcount ratios simultaneously.

3 Data and specification

3.1 Sample

For the analysis I use data of the German Socio-Economic Panel (SOEP) and calculate a multidimensional poverty index for three periods of time (2001–2002, 2006–2007, 2011–2012).[3] In particular, the SOEP provides information on various aspects of a respondent's life. However, to avoid an overload of the respondents, some questions are only asked every other year (or less frequently), whereas other items are only collected in between these years. Consequently, a comprehensive poverty index can only be calculated for selected years. Moreover, for using the best-suited items simultaneously, I merge two consecutive years into one period.

[3] I use SOEP data v29.1, provided by the DIW; see Wagner et al. (2007) for more details. The data used in this paper was extracted using the add-on package PanelWhiz for Stata. PanelWhiz (http://www.panelwhiz.eu) was written by Dr. John P. Haisken-DeNew (john@PanelWhiz.eu). See Haisken-DeNew and Hahn (2010) for details. The PanelWhiz-generated DO file to retrieve the data used here is available from me upon request. Any data or computational errors in this paper are my own.

Naturally, this comes at the cost of losing those observations not observed in both years of a period.

A useful target population for the present study are the adults living in Germany in the respective year. Consequently, I treat the SOEP as repeated cross-sectional data.[4] To account for the complex survey design of the SOEP, the subsequent analyses use sampling weights, which are basically the inverse sampling probabilities (see Goebel et al. 2008).

3.2 Operationalization

The basic prerequisite for any measurement exercise is a clear understanding of the theoretical construct to be measured. The operationalization of the present study draws on the capability approach (Sen 1985, 1992, 1999b).[5] The capability view not only considers human well-being as inherently multidimensional; moreover, it assigns intrinsic importance to functionings and capabilities. While functionings are the doings and beings individuals have reason to value (e.g., being healthy or participating in the social life), capabilities represent the set of all functionings an individual can actually choose from. Note that intrinsic importance naturally leaves room for instrumental importance as well, as being able to read and write or being healthy illustrate (e.g., Sen 1999b). Poverty, then, is understood as capability deprivation, implying both a shortfall in one or several of the functionings deemed relevant and their infeasibility for the individual in question.[6] Consequently, indicators of deprivation (1) need to be located in the functioning space and (2) ideally take account of the functioning's infeasibility.

Moreover, the CA requires value judgments to be exposed rather than concealed, and in addition they must be subjected to public debate. Only with clear presentation of the normative problem, the public debate about these issues can be expected to fulfill its constructive role; see Sen (1999a, p. 10). Value judgments are needed for (1) the selection of functionings included in the index, (2) the respective deprivation cutoffs, (3) the assigned weights, and (4) the poverty cutoff. The official RPW provide a first set of indicators, which aim at measuring important functionings. Specifically, so-called core indicators are to be regularly reported, and their selection is based on scientific advice (Arndt and Volkert 2007).[7] This selection is thus reasoned and transparent, and yet open to criticism and modification. Hence, the choice of dimensions is subjected to public debate (see also Sen 2004, on this). Subjecting the deprivation cutoffs to public debate, however, further constrains the choice of a functioning's *indicators*. Specifically, indicators should allow for deprivation cutoffs that are similar and meaningful across individuals, such that a

[4] Exploiting the panel setup of the data, implies a different concept of the samples' underlying population, i.e. the individuals living in Germany during the complete period investigated. Hence, such a setup ignores several groups by construction including migrants, individuals who become 18, die or otherwise leave the SOEP during the period investigated. Suppa (2016) exploits the panel setup of the data.

[5] For introductions to the capability approach see, e.g., Robeyns (2003, 2011), Alkire (2009).

[6] On poverty as capability deprivation, see in particular Sen (1992, ch. 7) and Sen (1999b, ch. 4).

[7] See also, e.g., Stiglitz et al. (2009), Atkinson et al. (2002), Marlier and Atkinson (2010).

public debate can study the pros and cons and eventually agree upon those cutoffs. Limitations of available data, however, prompt us to draw on imperfect indicators as well. In some cases a functioning may be only captured incompletely; in others, measurement remains within the resources space.

Finally, the CA assigns goods, income, and other resources only an instrumental role, as they are means, which can be converted into functionings. Remarkably, this conceptual structure reconciles merits of both the "absolute" and the "relative" approach to poverty, since relative deprivation in resources may well translate into absolute capability deprivation (see Sen 1983).

3.3 Dimensions

The increasing interest in alternative measures of well-being motivated numerous measurement initiatives in various directions. Additionally, a consensus on relevant dimensions is emerging. Table 1 provides an (non-exhaustive) overview of dimensions frequently suggested. While Nussbaum (2001) approaches the question philosophically, the other studies survey and organize available indicators. Nonetheless, they agree on certain dimensions such as education, health, or social participation.

However, Table 1 also reveals two further aspects. First, for some of the more complex functionings of human well-being, such as self-respect, practical reason, or agency, there are no accepted indicators so far. Second, several frequently proposed dimensions, are from a conceptual point of view *not* functionings. Hence, by themselves they are not dimensions of well-being. Leading examples are housing, material deprivation, and income. Conceptually, all of them provide resource information. In some cases, resource-indicators can be clearly related to a single key functionging, as e.g. housing indicators (even though conversion factors are then ignored). In constrast, many other indicators are likely to affect several functionings and, moreover, in an a priori unclear way (e.g., employment). Thus, they are best considered as multipurpose means.[8] The vital point is whether we should incorporate or ignore information provided by material deprivation indicators, income and other resource-based indicators. Ignoring crucial information about the lives the poor experience, poses a serious flaw of any poverty measure, just as adding redundant information. The present paper proposes to incorporate resource dimensions, if their indicators—argumentatively or evidentially—contribute important information on otherwise ignored functionings. For instance, indicators of material deprivation may be well-suited to signal a shortfall in both practical reason and economic security. Recent insights from behavioral economics (introduced later) lend support to this nexus. In contrast, a shortfall in income, is not included, since social participation, a key functioning income helps to achieve, is already explicitly modelled. This argument is reinforced by including material deprivation indicators which tend to better reflect material well-being than income. Consequently, adding an income dimension is likely to cause redundancy—given that material deprivation and social participation indicators are already included.

[8] Note that even housing indicators may not only affect "shelter" and "privacy" but also, say, health.

Table 1 Potential dimensions

Dimension	NB	ACMN	SSF	OECD	RPW	Functioning
Education	✔	✔	✔	✔	✔	✔
Health	✔	✔	✔	✔	✔	✔
Housing	(✔)	✔	✔	✔	✔	✗ (shelter, health, privacy)
Social participation	✔	✔	✔	✔	✔	✔
Political participation	✔		✔	✔	✔	✔
Agency						✔
Practical reason	✔					✔
Self-respect	✔					✔
Employment	(✔)	✔	✔	✔	✔	(?) (also self-respect, agency)
Income		✔		✔	✔	✗ (multipurpose)
Material deprivation	(✔)	✔	✔		✔	✗ (numerous, depends on items)
Environmental aspects	✔	✔	✔	✔	✔	✗ (health, shelter)
Time (activities)			✔	✔	✔	✗ (multipurpose)
Security	(✔)	(✔)	✔	✔	(✔)	(?) (secure functionings?)

✔ indicates that a dimension is explicitly mentioned and, in the last column, that it essentially complies with the demands of functionings; ✗ indicates that a dimension does not exactly match the demands of a functioning, basically because it refers to resources, strictly speaking; (✔) means that aspects of this dimensions are covered, but not explicitly mentioned as a dimension on their own; (?) indicates that in principle these dimensions could be thought of as functionings, but more research is needed on how to integrate these aspects into the capabilities approach

NB Nussbaum (2001), *ACMN* Atkinson et al. (2002), *SSF* Stiglitz et al. (2009), *OECD* OECD (2011)

Table 1 finally points to some unresolved issues: Is it better to consider security as a dimension on its own (e.g, Stiglitz et al. 2009, p. 194) or to introduce risky functionings (e.g., Wolff and de-Shalit 2007)? Likewise, how to account best for employment-related aspects requires still more investigation and debate.

3.4 Specification

Due to a lack of space, most indicators are only briefly introduced. The dimensions *material deprivation* and *employment* are, however, discussed in more detail. Table 2 shows the selected functionings, their indicators, and the weights. Almost all indicators are either already core indicators of or analyzed within the RPW.[9]

3.5 Education

Education is meant to capture not only achievements in reading and writing, but also the abilities to use one's senses, to imagine, think, and reason (see Nussbaum 2001). The first indicator (*dep_educ*) switches to deprivation if a respondent failed to

[9] See, e.g., Bundesregierung (2013, pp. 461–491) or Wissenschaftszentrum Berlin für Sozialforschung (WZB) (2013).

Table 2 Functionings, indicators, and weights

Functioning	Deprivation cut-off	Variable	Weight
Education	Elementary schooling not completed or elementary schooling completed but no vocational qualification[a]	dep_educ	$\frac{1}{12}$
	Less than 10 books in household	dep_nbooks	$\frac{1}{12}$
Housing	House requires major renovation or is ready for demolition	dep_housecond	$\frac{1}{18}$
	Neither of bath or shower, kitchen, warm water, toilet	dep_hhfacilities	$\frac{1}{18}$
	Overcrowded (less than one room per person)	dep_overcrowded	$\frac{1}{18}$
Health	Partially or severely disabled	dep_disability	$\frac{1}{18}$
	Reporting 2/4 health issues[b]	dep_healthidx	$\frac{1}{18}$
	Body mass index larger than 30	dep_obesity	$\frac{1}{18}$
Material deprivation	Reporting 2/4 goods missing for financial reasons[c]	dep_matdep	$\frac{1}{18}$
	None of life insurance, pension, owning the house or apartment, other house, financial assets, commercial enterprise, tangible assets	dep_wealth	$\frac{1}{18}$
Social participation	5/7 Activities performed *never* [d]; remaining at most *less than monthly*	dep_actindex	$\frac{1}{12}$
	Never meeting friends	dep_meetfriends	$\frac{1}{12}$
Employment	Unemployed	dep_unemp	$\frac{1}{6}$
	Invol. hours worked <30	dep_underemp	$\frac{1}{18}$
	Precariously employed (incl. temporary work)	dep_precemp	$\frac{1}{18}$

[a] Graduation in Germany is usually achieved after 10 years of schooling. [b] The four health issues are (1) a *strong* limitation when climbing stairs, (2) a *strong* limitation for tiring activities, (3) physical pain occurred *always* or *often* during the last 4 weeks, and (4) the health condition limited *always* or *often* socially. [c] The four goods asked for are (1) a warm meal, (2) whether friends are invited for dinner, (3) whether money is put aside for emergencies, and (4) whether worn out furniture is replaced. [d] Activities included are (1) going to the movies, pop music concerts, dancing, disco, etc, (2) going to cultural events (such as concerts, theater, lectures), (3) doing sports yourself, (4) volunteer work, (5) attending religious events, (6) helping out friends, relatives or neighbours (7) involvement in a citizens' group, political party, local government

complete elementary education or completed elementary education but later failed to obtain a vocational qualification. Elementary education refers to the graduation after Germany's 10 years of compulsory education. Beyond formal education, I also consider the number of books within the household. Members of a household owning less than 10 books are considered deprived (*dep_Nbooks*). This information proxies both the educational climate within the household and effective literacy.[10] However, as a proxy located in the resource space, it suffers the usual limitations (potentially important conversion factors are ignored).

[10] This indicator is used frequently to study the influence of constructs like "scholarly culture" of the parental household on children's educational attainments (see, e.g., Evans et al. 2010), and is, moreover, applied by the OECD as well (see, e.g., OECD 2014).

3.6 Health

Deprivation in health, which is multidimensional itself, is signalled by three indicators. First, respondents are deprived in bodily integrity if they are partially or severely disabled (*dep_disability*). Second, I compile a sub-index, which allows for substitutability among several medical conditions. Two out of four health problems must be reported for being deprived. The four health issues are (1) a *strong* limitation when climbing stairs, (2) a *strong* limitation for tiring activities, (3) physical pain occurred *always* or *often* during the last 4 weeks, and (4) the health condition limited *always* or *often* socially. Finally, a BMI larger than 30 (*dep_obesity*) indicates obesity (WHO 2000, p. 242) and thus is medically critical. Note that for these indicators the deprivation cutoffs are similar and meaningful across individuals—avoiding a common drawback of indicators like subjectively assessed health state or health satisfaction.

3.7 Housing

Housing indicators are to capture the functionings of being sheltered and enjoying privacy. To measure housing, I resort to resource indicators. Specifically, I consider a person to be deprived of adequate shelter and privacy if any of bath, kitchen or toilet is missing in her accommodation (*dep_hhfacilities*) or if the respondent reports that her house either "requires major renovation" or is "ready for demolition" (*dep_housecond*). Finally, I use a simple overcrowding index (*dep_overcrowded*), which indicates deprivation if there is less than 1 room per person in the household (see Bundesregierung 2013, p. 243). Drawing on resource indicators, however, ignores relevant conversion factors (e.g., the power relations within the family). Moreover, a decent housing may also facilitate more health, self-respect and social participation.

3.8 Social participation

The measurement of social participation exploits information on the frequency with which certain activities are reported to be performed. These activities represent common forms of social life. Respondents may report *at least once a week*, *at least once a month*, *less often*, or *never*. Table 11 contains the exact wording of the questions. While meeting friends or relatives, the social activity *par excellence*, is of central importance, many other activities also facilitate relatedness and social interaction. To emphasize the importance of meeting one's friends (for its own sake), I consider a person deprived if she reports to *never* meet her friends. The remaining seven items form an activity index. Specifically, the activity index considers an individual deprived if she reports *never* performing six or seven activities or, alternatively, *never* performing five activities and, additionally, performing one or two activities *less often*.

3.9 Material deprivation

Inspired by the work of Townsend (1979) and others, previous poverty measures also used indicators for consumption or ownership on selected goods. Conceptually goods, like income, are resources. Notwithstanding, resource indicators may provide extra information. Material and wealth deprivation are best considered as a shortfall in a multipurpose means. Lacking multipurpose means may affect several distinct functionings simultaneously and, moreover, in an a priori unclear way. This paper proposes to use resource dimensions, if their indicators argumentatively or evidentially contribute extra information on otherwise ignored functionings. More specifically, I argue that indicators of material and wealth deprivation are well-suited to infer a shortfall in both practical reason and economic security.

Nussbaum (2001) suggests the functioning *practical reason*, referring to an individuals' capacity to act and to plan one's life, including the ability to perform deliberate and reasoned actions.[11] In economic choice theory this corresponds to the activity of balancing costs and benefits. The proposed justification for material deprivation draws on recent research from behavioral economics. Specifically, Mullainathan and Shafir (2013) argue economic conditions to systematically distort decision-making via the so-called scarcity mindset. Important implications are both focus dividend and tunneling.[12] The authors conclude (p. 119), "When we focus so intensely on making ends meet now, we plan less effectively for the future". Later (pp. 120–121), they continue, "myopia is not a personal failure. Tunneling is not a personal trait. [...] rather, it is the context of scarcity that makes us all act that way".[13] Individuals struggling hard to make ends meet are fully occupied with monitoring every penny spent and earned. Consequently, long-run effects (be it costs or benefits) and goals are located outside the tunnel, and hence ignored. Since it is these economic conditions that induce (*inter alia*) myopia, decision making is systematically distorted.

Material and wealth deprivation are also suited to signal a lack of economic security. Goods not consumed for financial reasons already indicate difficulties to make ends meet, and thus a threatened level of consumption. The role of wealth (and borrowing) in consumption smoothing is theoretically supported by the permanent income hypothesis. Finally, depending on the specific goods used, material deprivation indicators may also indicate shortfalls in even other functionings (e.g., respecting oneself).

The dimension of material deprivation is operationalized using two sub-indices, which allows a certain substitutability. First, *dep_wealth* equals one if none of the following wealth items is owned: life insurance, pension, house or apartment,

[11] Though related to agency, both concepts are distinct. Agency refers to the ability to set one's own goals and eventually strive for them, e.g., to opt for an austere and spiritual life style (e.g., (Sen 1992), ch. 4). In contrast, practical reason refers also to technical and operational decisions. However, deprivation in practical reason may well entail deprivation in agency.

[12] Poorer people, for instance extract a focus dividend as they are found to be robust to commonly found framing effects (Mullainathan and Shafir 2013, ch. 4, survey the evidence).

[13] Shah et al. (2012), Mani et al. (2013) provide more evidence and elaborate this line of thought.

financial assets, commercial enterprise, tangible assets.[14] Second, *dep_matdep* equals one if two or more items of the following are missing for financial reasons (1) a warm meal, (2) friends are invited for dinner, (3) money is put aside for emergencies, and (4) worn out furniture is replaced. Both indicators are suited to detect shortfalls in practical reason and both indicators capture important aspects of economic insecurity. Consequently, extra information on otherwise ignored functionings is added.

3.10 Employment

Previous studies either include an employment dimension or explicitly advocate an *employment capability* (e.g., Leßmann and Bonvin 2011; Alkire and Apablaza 2016). In fact, by now there is widespread agreement about the importance of employment for human well-being (e.g., Stiglitz et al. 2009; Bundesregierung 2013). Employment may indeed help to do things which are intrinsically important (e.g., contributing one's share for the good of all). However, an array of effects of labour on other dimensions of well-being has been documented as well. In fact, most information collected for the labour-well-being nexus usually pertains to its instrumental relevance (e.g., occupational diseases and risks for accidents, various security schemes, workers' participation in various processes, exposure to adverse conditions, etc.). Suppa (2015) argues labour to be a crucial device for achieving numerous functionings, such as being healthy, agency, self-respect, practical reason, appearing in public without shame, etc.

Unemployment, for instance, was found to decrease life satisfaction (Kassenböhmer and Haisken-DeNew 2009) and public social participation (Kunze and Suppa 2017). Hetschko et al. (2013) find identity utility to be important, which from a capability view may indicate an effect on being ashamed or respecting oneself. If, however, perfect measures for all relevant functionings were available, there would be no need to rely on an unemployment indicator. As it stands, however, accepted measures for many of the more complex functionings are lacking and existing ones might be incomplete. Thus, similar to the material deprivation indicators, employment-related indicators may provide important extra information on otherwise ignored functionings.

The current specification draws on three employment-related indicators. First, if an individual reports to be registered unemployment *dep_unemp* equals one. As outlined above deprivation in numerous functionings a likely to accompany unemployment. Moreover, *dep_underemp* equals one if a person reports to involuntarily work less than 30 h a week. This may be associated by shortfalls in similar functionings, although to a lesser extend. Moreover, part-time jobs are often found to provide lower job quality. Restricting deprivation to the *involuntary* is important, since for many households part-time work may, in fact, be desirable for improving the work-life balance. Finally, *dep_precemp* equals one for persons who

[14] The absence of wealth items indicates what Mullainathan and Shafir (2013, ch. 3) call slack. In their suitcase-packing metaphor, slack is space accidentally left here and there. Among other things, slack also provides room to fail, i.e., less disastrous consequences of erroneous actions.

are marginally employed or in temporary employment. Associated deprivations are in social and economic security and practical reason.

3.11 Weights

The main specification assigns equal weights to each dimension and, within a dimension, equal weights to each indicator. Consequently, most indicators receive a weight of $\frac{1}{18}$, whereas education and social participation indicators receive $\frac{1}{12}$ each. Finally, note that full deprivation in employment is only achieved by unemployed (weighted with $\frac{1}{6}$). Assigning the other two indicators a weight of $\frac{1}{18}$ each, implies an improvement for a formerly unemployed, who finds a precarious part-time job.

3.12 Deprivation headcounts

Table 3 provides first information about deprivation indicators. The uncensored deprivation headcount is simply the share of individuals deprived in a given indicator. Uncensored headcounts for the whole population (total) indicate different levels of prevalence for different dimensions. Housing indicators, for instance, vary from 1 to 5%. Similarly, employment indicators vary from 4 to 7%, whereas deprivations in wealth or social participation amount up to 20% each. The so-called dashboard approach exclusively relies on these headcount ratios along with their

Table 3 Deprivation headcount ratios

	Uncensored headcount			Censored headcount	Share non-poor depr
	Non-poor	m-Poor	Total	Non-poor	Non-poor
dep_educ	8.54	47.13	12.64	5.01	60.40
dep_Nbooks	3.22	29.22	5.98	3.10	48.13
dep_healthidx	11.59	40.95	14.71	4.35	70.43
dep_disability	12.44	31.91	14.51	3.39	76.64
dep_obesity	16.88	37.18	19.04	3.95	79.26
dep_housecond	1.69	8.19	2.38	0.87	63.45
dep_overcrowded	4.21	13.44	5.19	1.43	72.50
dep_hhfacilities	0.96	3.86	1.27	0.41	67.61
dep_matdep	11.51	66.94	17.39	7.11	59.13
dep_wealth	17.63	78.93	24.14	8.38	65.28
dep_actindex	17.15	62.72	21.99	6.66	69.71
dep_meetfriends	18.79	54.04	22.53	5.74	74.53
dep_unemp	1.00	31.98	4.29	3.40	20.77
dep_underemp	5.71	10.03	6.17	1.07	82.74
dep_precemp	6.09	10.68	6.58	1.13	82.77

Data from SOEP v29.1. Calculations for 2011/2011, cells contains percentages. Underlying poverty cutoff $k = 33$

changes (i.e. the marginal distributions). However, the uncensored headcount ratio can also be calculated for certain subgroups, e.g., by poverty status. While only 1% of the non-poor is found unemployed, 32% of the multidimensional poor are. Table 3 also reveals that the most prevalent deprivations among the poor are material deprivations (67–79%) and social participation (54–62%). Similarly, 47% of all poor are deprived in education. Given the counting approach to poverty, higher prevalences for the poor are to be expected. In fact, prevalences are substantially larger for the poor—often by a triple or more. This finding simply mirrors the fact, that the AFM exploits the joint distribution of deprivation in the identification step of poverty measurement. Put differently, the AFM uses the joint distribution to distinguish more important (i.e. coupled) from less important (i.e. occasional) deprivations.

In addition to this, Table 3 also shows the censored headcount ratios, i.e. the share of the population who is poor *and* deprived in the given indicator. While the censored headcount must be smaller or equal the uncensored headcount, it is important to note that none of the censored headcounts is really close to its uncensored headcount. Thus, virtually no indicator directly implies poverty (i.e. multiple deprivation). The final column contains the share of a given deprivation borne by the non-poor. For most indicators the non-poor account for 50% or more of a deprivation. The only exception is unemployment, where only 20% of the unemployed are non-poor (which results from the higher weight). Note that remarkable shares of deprivations are deliberately ignored in the subsequent analysis, as they are not coupled with other deprivations. More importantly, to infer from a declining uncensored headcount ratio what happens to the multiply-deprived becomes a doubtful exercise for the data at hand (see Suppa 2017). In sum, these findings suggests that neither a single indicator, nor a dashboard approach can replace the multidimensional approach.

4 Empirical analysis

4.1 Aggregate measures

Figure 1 depicts the multidimensional poverty measure M_0, the incidence H, and the intensity A—each for all three periods and for poverty cutoffs $k \in [25, 50]$. Figure 1 suggests for both M_0 and H an increase from period 1 to 2 and a decrease from period 2 to 3—independent of k. Average intensity seems to be lowest in 2001/02. Setting $k = 33$ implies 10.7% to be poor, whereas a more conservative cutoff, say $k = 38$, implies a headcount ratio of 6.8%.

To obtain a more detailed account of multidimensional poverty Fig. 2 shows M_0 for different subpopulations. Apparently, individuals with a background of migration exhibit a larger M_0, irrespective the poverty cutoff chosen. Likewise, East-Germany and women experience more multidimensional poverty, although with less pronounced differences. The results are less clear-cut for different age groups, since they depend on the chosen poverty cutoff k. People aged 45–65, however, tend to experience most multidimensional poverty.

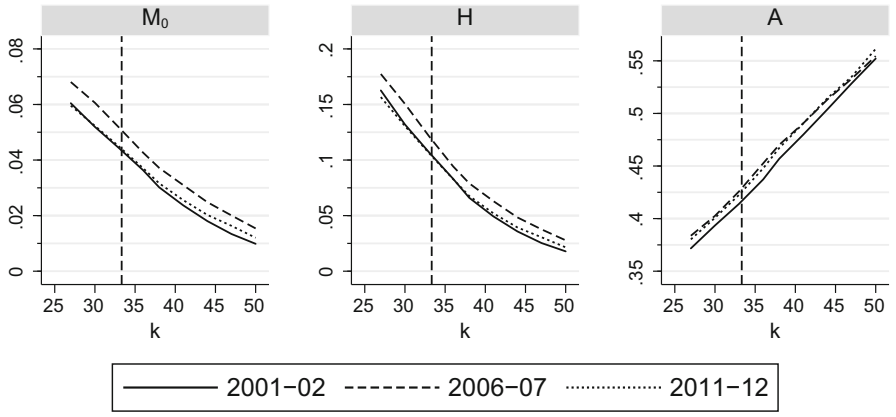

Fig. 1 Aggregate measures over time. *Notes* Data from SOEP v29.1

Figure 2 also uncovers that persons in single households tend to experience more poverty than individuals in households of couples, regardless of eventual children in the household. Finally, the importance of the father's education on an individual's deprivation is salient. Three groups need to be distinguished: First, persons with fathers completely lacking education or where education is unknown are associated with the highest M_0. The second group consists of individuals whose father completed *Hauptschule* or other schools, while the third contains those whose fathers completed *Realschule* and *Abitur*. Differences in average intensity vary less by subgroup (results available upon request).

Note that these insights, generated by the adjusted headcount ratio, are consistent with previous findings. The systematic discrimination of individuals with migration backgrounds is just as well documented as the influence of the family background on the offspring's educational achievements (e.g., Bundesregierung 2008, ch. IX and III.5).

4.2 Contributions of subpopulations

In addition to an analysis of multidimensional poverty by socio-demographic groups, overall multidimensional poverty can also be decomposed into the contributions of each group to account for relative population sizes (see Eq. 1). Setting to $k = 33$, Table 4, shows such a decomposition for the father's educational background. Specifically, respondents reporting their fathers to have completed *Hauptschule* alone make up approximately $\frac{2}{3}$. Including individuals reporting their father's education to be unknown, uncompleted, or absent, the share of multidimensional poverty associated with a handicapped education of the father climbs to ca. 85%. Even though the corresponding population share is 69%, this finding clearly underlines the role of the educational background of the father in multidimensional poverty.

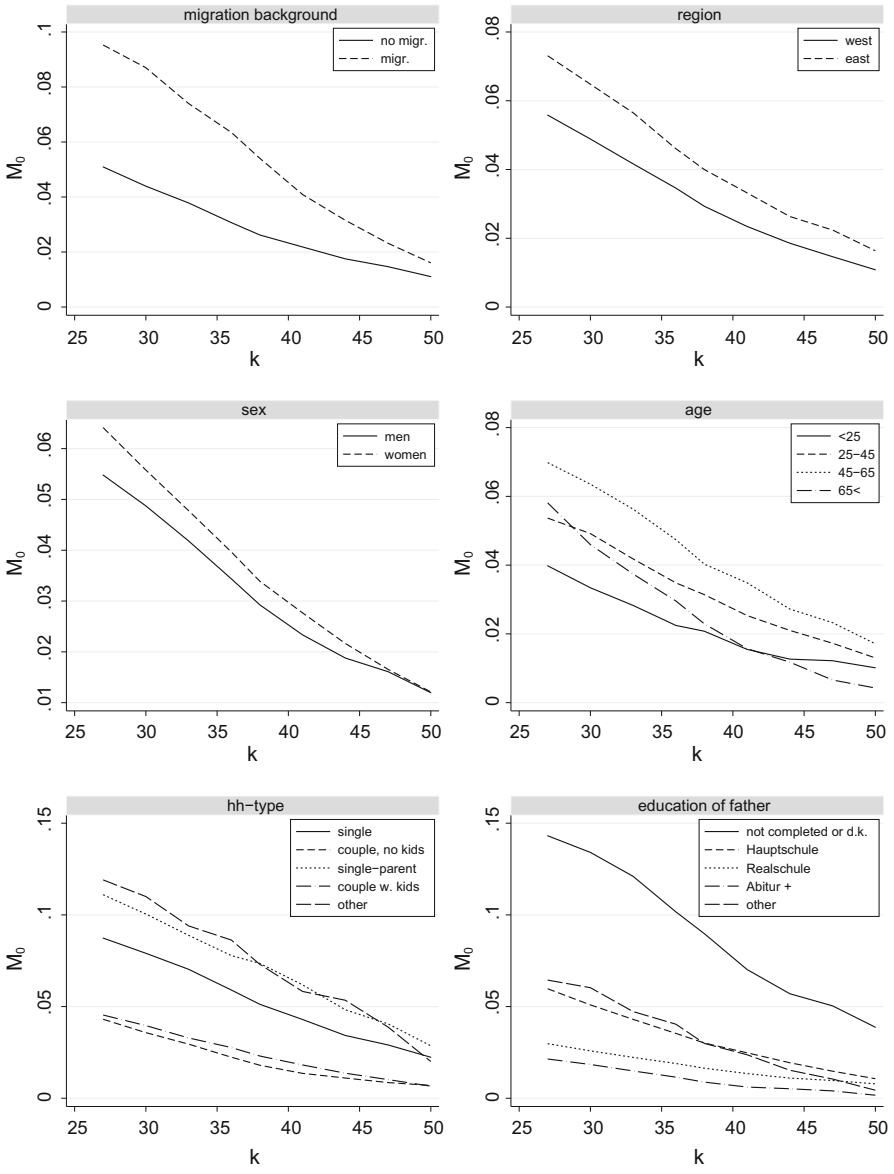

Fig. 2 M_0 by subgroups. *Notes* Data from SOEP v29.1. calculations for 2011/2012

4.3 Dimensional breakdown

Multidimensional poverty (M_0) can also be decomposed into each indicator's contribution using Eq. (2). The contribution of indicator d can be expressed absolutely, $\frac{w_d}{D} h_d(k)$, summing to M_0, or relatively, $\frac{w_d}{D} \frac{h_d(k)}{M_0}$, summing to 100%. Table 5 (a) reveals social participation, material deprivation and unemployment to

Table 4 Contributions to M_0 and H by Education of Father

	M_0	H	Population share
Abitur+	4.36	4.65	10.75
Realschule	7.51	7.42	13.28
Hauptschule	56.94	57.12	63.02
Other	3.24	3.41	2.94
Not completed or d.k.	27.95	27.40	10.02
	100.00	100.00	100.00

Data from SOEP v29.1. Year of analysis is 2011/12, cells contain percentages. Poverty cutoff $k = 33$

contribute most to M_0, whereas housing indicators contribute least. Even though, dimensional contributions are broadly similar over the years, Table 5 (a) also suggests employment and material deprivation indicators to become more important over the decade, both absolutely and relatively. Apparently, these indicators also account for the peak of M_0 in 2006/07.

To study different profiles of poverty, dimensional breakdowns can be calculated for subgroups. Table 5 (b) suggests absolute and relative contributions of social participation and health to increase with age. Material deprivation indicators contribute slightly less in old age. For persons with a background of migration, material deprivation and housing contribute relatively more to multidimensional poverty, whereas health indicators contribute relatively less. Absolute contributions, however, reveal virtually every indicator to contribute to the higher M_0 for persons with migration background.

4.4 Dynamics

Indeed, the period of investigation covers, among other things, a major labour market reform, which was implemented in several steps over the decade (along with some modifications), and the financial crisis starting in 2007. Unfortunately, a more careful evaluation of these events is, however, difficult with data for only three points of time. Nonetheless, a natural starting point for studying poverty dynamics is to document changes over time. Table 6 (a) contains absolute and relative changes in M_0 for several k. Irrespective of k, multidimensional poverty is growing during the first and falling during the second part of the decade. Moreover, Table 6 indicates that over the whole decade, multidimensional poverty remains approximately unchanged for $k = 33$, but would have increased for $k \geq 44$ and decreased for $k < 33$. In order to obtain a deeper insight into changes of multidimensional poverty one can compare changes in censored and uncensored headcounts, which are both depicted in Table 6 (b). Specifically, the three employment indicators and the material deprivation indicator exhibit relatively high changes in both censored and uncensored headcounts during the first half of the decade. Apparently, these four indicators drive the overall increase in multidimensional poverty observed from 01/02 to 06/07. Similarly, indicators for education and unemployment play a crucial role for reducing M_0 during the second half of the decade.

Other patterns, however, are more difficult to rationalize and require a more careful analysis. The *un*censored headcount of education, like several other

Table 5 Dimensional breakdowns

(a) By years

	Rel. contributions (in %)			Abs. contribution (in $M_0 \times 100$)		
	2001–2002	2006–2007	2011–2012	2001–2002	2006–2007	2011–2012
dep_educ	11.10	9.61	9.32	0.49	0.50	0.42
dep_Nbooks	7.03	6.29	5.52	0.32	0.33	0.26
dep_healthidx	5.53	5.23	5.49	0.24	0.27	0.24
dep_disability	4.21	3.91	4.28	0.18	0.20	0.19
dep_obesity	4.07	4.36	4.95	0.18	0.23	0.22
dep_housecond	1.15	1.25	1.04	0.05	0.07	0.05
dep_overcrowded	1.97	1.74	1.77	0.09	0.09	0.08
dep_hhfacilities	1.15	0.59	0.51	0.05	0.03	0.02
dep_matdep	10.18	13.03	13.21	0.46	0.67	0.59
dep_wealth	15.08	14.92	15.85	0.66	0.77	0.70
dep_actindex	14.63	13.23	12.56	0.64	0.67	0.56
dep_meetfriends	10.65	9.77	10.71	0.47	0.50	0.48
dep_unemp	11.80	13.83	11.95	0.54	0.74	0.57
dep_underemp	0.68	1.04	1.38	0.03	0.05	0.06
dep_precemp	0.78	1.20	1.45	0.03	0.06	0.06

(b) Relative contributions for age and migration status

	Age groups				Migration background	
	<25	25–45	45–65	65<	No	Yes
dep_educ	12.57	10.22	6.97	12.19	8.48	11.09
dep_Nbooks	7.26	5.11	4.59	7.51	5.98	4.57
dep_healthidx	0.74	2.56	5.82	9.43	6.09	4.22
dep_disability	1.10	1.98	4.92	6.51	4.90	2.98
dep_obesity	2.52	3.76	5.43	5.98	5.20	4.42
dep_housecond	0.93	1.10	1.18	0.70	1.14	0.82
dep_overcrowded	3.53	4.12	0.95	0.16	1.01	3.37
dep_hhfacilities	0.12	0.17	0.50	1.03	0.49	0.57
dep_matdep	15.68	14.58	14.27	8.90	12.93	13.77
dep_wealth	20.18	17.19	14.79	15.38	15.20	17.21
dep_actindex	9.17	10.65	11.60	17.53	12.40	12.90
dep_meetfriends	6.21	7.57	11.61	13.74	11.04	10.03
dep_unemp	17.36	17.95	13.65	0.11	12.58	10.63
dep_underemp	0.54	1.71	1.82	0.29	1.12	1.91
dep_precemp	2.10	1.34	1.91	0.53	1.43	1.51

Data from SOEP v29.1. Poverty cutoff $k = 33$

Table 6 Changes in the adjusted headcount ratio

(a) Absolute and relative changes for different k

k	01/02–06/07		06/07–11/12		01/02–11/12	
	ΔM_0	δM_0	ΔM_0	δM_0	ΔM_0	δM_0
11	0.0057	0.0483	−0.0091	−0.0738	−0.0034	−0.0292
22	0.0059	0.0708	−0.0086	−0.0960	−0.0027	−0.0320
33	0.0074	0.1676	−0.0068	−0.1323	0.0006	0.0131
44	0.0068	0.3770	−0.0046	−0.1845	0.0022	0.1230
50	0.0055	0.5633	−0.0034	−0.2181	0.0022	0.2223

(b) Changes in censored and uncensored deprivation headcount ratios

	01/02–06/07		06/07–11/12		01/02–11/12	
	δh_d	$\delta h_d(k)$	δh_d	$\delta h_d(k)$	δh_d	$\delta h_d(k)$
dep_educ	−0.139	0.013	−0.144	−0.161	−0.263	−0.150
dep_Nbooks	−0.017	0.016	−0.176	−0.210	−0.190	−0.198
dep_healthidx	−0.062	0.108	0.040	−0.095	−0.024	0.003
dep_disability	−0.023	0.093	0.043	−0.055	0.019	0.033
dep_obesity	0.159	0.264	0.123	−0.026	0.302	0.232
dep_housecond	0.077	0.259	−0.201	−0.295	−0.140	−0.113
dep_overcrowded	−0.183	0.014	−0.066	−0.142	−0.236	−0.130
dep_hhfacilities	−0.485	−0.398	−0.164	−0.293	−0.569	−0.574
dep_matdep	0.622	0.480	−0.140	−0.122	0.395	0.299
dep_wealth	−0.021	0.162	−0.005	−0.087	−0.026	0.061
dep_actindex	−0.088	0.058	−0.101	−0.177	−0.180	−0.129
dep_meetfriends	−0.024	0.079	0.017	−0.047	−0.007	0.028
dep_unemp	0.116	0.370	−0.312	−0.231	−0.232	0.054
dep_underemp	0.472	0.751	0.060	0.146	0.561	1.007
dep_precemp	0.579	0.797	0.014	0.052	0.600	0.891

(c) Changes in M_0 by population subgroup

	01/02–06/07		06/07–11/12		01/02–11/12	
	ΔM_0	δM_0	ΔM_0	δM_0	ΔM_0	δM_0
west	0.0064	0.1498	−0.0075	−0.1523	−0.0011	−0.0253
east	0.0106	0.2097	−0.0046	−0.0759	0.0060	0.1178
men	0.0119	0.3282	−0.0065	−0.1339	0.0055	0.1503
women	0.0031	0.0597	−0.0072	−0.1303	−0.0041	−0.0784
<25	0.0114	0.3251	−0.0184	−0.3938	−0.0069	−0.1967
25-45	0.0075	0.2040	−0.0025	−0.0558	0.0050	0.1368
45−65	0.0136	0.2788	−0.0062	−0.0991	0.0074	0.1521
65<	−0.0028	−0.0536	−0.0127	−0.2531	−0.0155	−0.2932
no migr. backgr.	0.0056	0.1527	−0.0047	−0.1098	0.0010	0.0261

Table 6 continued

(c) Changes in M_0 by population subgroup

	01/02–06/07		06/07–11/12		01/02–11/12	
	ΔM_0	δM_0	ΔM_0	δM_0	ΔM_0	δM_0
migr. backgr.	0.0138	0.1673	−0.0225	−0.2330	−0.0087	−0.1047

Data from SOEP v29.1. Poverty cutoff in panels (b) and (c) is $k = 33$

indicators, falls during the first part of the decade. In contrast, the respective censored headcount of education (at $k = 33$) hardly changes at all. This finding simply means that the same share of the population is still multidimensionally poor *and* deprived in education—despite the decrease in the *un*censored headcount. Likewise, over the decade unemployment among the poor is unaffected by the substantial reduction of the unemployment rate. Moreover, censored headcounts also suggest that precarious employment and underemployment increase among the poor during the second half of the decade, despite the overall decrease in M_0 for this period.

A complementary analysis is to study changes by subpopulations. A simple and yet instructive exercise compares absolute changes in M_0 by selected subgroups. Note, however, that the poor people at the beginning of the period may not be the same as the poor people at the end—even though they may exhibit the same socio-demographic characteristics. Table 6 (c) shows both absolute and relative changes by four different subgroups. East-Germany, for instance, experiences both a larger rise during the first half and a smaller fall during the second half. Notably, this implies the multidimensional poverty gap between both regions to grow during the period investigated. Moreover, while most age groups first experience a higher M_0, only youngest (<25) and oldest (65+) people are finally better off. Even though the group of people with a background in migration experienced a stronger increase during the first half, they undergo an even stronger relief during the second half of the decade. Taken together, the gap between migrants and non-migrants is shrinking. Likewise, I find a slightly decreasing gender gap for multidimensional poverty.

4.5 Interim conclusions

The empirical analysis reveals distinct profiles of poverty (e.g. for the elderly or migrants). Moreover, the findings also highlight the role of the education of the father, evidently an important factor for multidimensional poverty. Independent of the the poverty cutoff, multidimensional poverty rose during the first and fell during the second half of the decade. While remaining approximately unchanged for $k = 33$, more conservative cutoffs imply an increase for the decade. A more detailed analysis suggests unemployment and material deprivation as critical factors behind changes in multidimensional poverty. However, as the poor might be hit by very

different trends simultaneously, a more complex picture emerges. Precarious and underemployment, for instance, rise throughout the decade, whereas unemployment and material deprivation both peak in 06/07. While unemployment later falls even below its initial level, material deprivation remains above. The dynamics behind changing gaps between subpopulations in multidimensional poverty may add even more depth to explanations of poverty.

5 Multidimensional poverty and income

5.1 Multidimensional and income poverty

Income-poverty is both an alternative to multidimensional poverty measures and a potential dimension. Table 7 (a) contrasts the headcount ratios for income and multidimensional poverty. Note that $k = 33$ and 60%-of-median-income imply similar incidences (ca. 11–13%) during the first years. Monetary poverty, however, also rises from 2006/07 to 2011/12, for which multidimensional poverty is falling. Suppa (2016) studies changes in both measures more carefully.

An important question is whether both measures identify the same individuals as poor. Naturally, such a comparison depends on the poverty cutoffs. Table 7 (b) shows the population shares of individuals who are considered poor (1) by both measures (both-poor), (2) by income poverty only (IO-poor), and (3) by multidimensional poverty only (MDO-poor). For $k = 33$ and an income poverty cutoff of 60% only 5% of the population is identified as poor by both measures. Moreover, 8% are IO-poor and 5% are MDO-poor. Neither other cutoffs nor years essentially affect this finding (further results available upon request). Generally less than 50% of the income-poor are also multidimensionally poor. As both measures substantially disagree on who is poor, different policy implications are to be expected.

5.2 Income as a dimension?

Previous studies frequently used income as a dimension. Indeed this paper, proposes to use resource dimensions as well—however only if their indicators, argumentatively or evidentialy, contribute extra information on otherwise ignored functionings. Abandoning a lack-of-income dimension may result in ignoring multiply deprived, whereas including such a dimension introduces the risk of double-counting. Rather than counting a novel deprivation, the income-driven lack of, say, health or social participation is counted once again.

Thus, a lack-of-income dimension necessitates missing functionings. Frequently social participation is a reasonable candidate. As social participation is shaped by customs, organization and endowment of a society, it is also often used to justify a *relative* income-poverty cutoff. Consequently, adding a lack-of-income dimension is sensible if social participation is unavailable as a separate dimension. Similar arguments may apply for other functionings like practical reason or economic security. However, the present study conceptually prefers material deprivation

Table 7 Income and multidimensional poverty

(a) Headcount ratios for different cutoffs

	Income poverty		Multidimensional poverty			
	50%	60%	$k = 27$	$k = 33$	$k = 38$	$k = 44$
2001/02	5.65	11.17	16.55	10.86	6.66	3.63
2006/07	6.12	12.63	17.87	12.37	8.16	5.00
2011/12	7.05	13.49	15.90	10.72	6.82	3.98

(b) Population shares identified as poor by poverty measure

	50% of median income				60% of median income			
	$k = 27$	$k = 33$	$k = 38$	$k = 44$	$k = 27$	$k = 33$	$k = 38$	$k = 44$
both-poor	3.83	3.03	2.39	1.46	6.70	5.25	3.99	2.51
IO-poor	3.21	4.01	4.66	5.59	6.79	8.25	9.50	10.99
MDO-poor	12.06	7.69	4.43	2.52	9.20	5.48	2.83	1.48

Data from SOEP v29.1. Year of analysis in panel (b) is 2011/12. Cells contain percentages. Underlying income concept is real net household equivalence income

indicators to an lack-of-income dimension: First, material deprivation indicators can be linked more closely to specific functionings, as practical reason and economic security (see Sect. 3). Moreover, consumption is often argued to better proxy material well-being than income (e.g., Slesnick 2001).[15]

5.3 Who are the IO-poor?

The individuals potentially added or ignored as poor are the IO-poor. To assess whether IO-poor should, in fact, be considered multidimensionally poor as well, one can compare their deprivations with those of the non- and both-poor. Table 8 provides information about the incidence of deprivations and the (uncensored) deprivation count by poverty status. Indeed, the IO-poor exhibit a slightly higher average deprivation count of 0.17 compared with the non-poor (0.1). Their deprivation count is, however, much lower than that of the MDO- or both-poor (0.4 and 0.45) and it is also not just barely below the poverty cutoff. While most deprivation indicators are similar in size for IO-poor and non-poor, the outstanding exceptions are both material deprivation indicators, which are substantially higher for the IO-poor and also can explain their higher deprivation count. This finding points to a sizeable overlap of material deprivation indicators with income-poverty and, moreover, weakens the concern that IO-poor are actually multiply deprived.

[15] If one still wanted to add an income dimension the question how to choose a reasonable cutoff remains, but then in presence of the other dimensions already included.

5.4 Income and material well-being

Conversely, one may also question that low income accurately reflects material well-being, in particular for the IO-poor. In fact, Slesnick (2001, pp. 196–197), notes that this applies in particular for young and elderly persons. One reason for income to underestimate actual consumption is that it ignores the role of wealth. Wealth can be directly consumed, but may also provide a service flow from its stock (e.g., self-occupied property or durables). Another reason is that permanent rather than current income matters for consumption, implying students, for instance, to be on a different consumption trajectory than their even-aged contemporaries.

As also shown by Table 8, the young (aged 30 and below) are not only overrepresented among the IO-poor, moreover, together with the elderly (aged 60 and above) they account for ca. 60% of the IO-poor. Table 8 also contains frequently collected wealth information. It turns out, that 24% of the IO-poor own their accommodation and 64% own a car, indicating a substantial share of this group to have indeed access to wealth.

5.5 The role of wealth

To illuminate the role of wealth for the present context, I exploit data collected by a comprehensive wealth module in 2002 and 2007 (Frick et al. 2007). Table 9 provides information on wealth by income poverty and material deprivation status, the latter meaning individuals are deprived in at least one material deprivation indicators. Interestingly, if individuals report to be non-deprived according to both material deprivation indicators, almost half the respondents own their accommodation—whether income poor or not. Moreover, 72% of the not materially deprived, but income poor report to own a car, and 78% own wealth totalling 7.000 EUR or more. Indeed, their median net wealth is with around 66.000 EUR, quite substantial. If however respondents report to be materially deprived, all wealth indicators drop substantially (only car ownership falls less). These observations are important for two reasons: first they document a certain number of income-poor to own significant wealth and, second, that material deprivation indicators seem to capture this quite accurately (despite relying on considerably less questions than the comprehensive wealth module).

Finally, 10 partitions the income-poor by wealth ownership, material deprivations, and multidimensional poverty status in order to gauge the scope for incorrectly ignored IO-poor. Apparently, 60% of the income-poor do not own wealth and are materially deprived, i.e. in these cases low income and a lack of wealth manifest in material deprivation. Another ca. 15% are materially deprived despite owning some wealth, implying a total of 75% of the income-poor to be materially deprived in at least one of the indicators. Another, 20% of the income-poor, which are IO-poor in fact, report to own wealth and not to be materially deprived, suggesting income to reflect their material well-being inaccurately. The remaining 5% of the income-poor, however, lack wealth and do not report material deprivation. As the low income of this group neither manifests in material

Table 8 Deprivation rates and socio-economic characteristics by poverty status

	(1) Non-poor	(2) Both-poor	(3) IO-poor	(4) MDO-poor
Deprivations				
dep_educ	9.88	48.56	17.05	52.23
dep_Nbooks	3.39	37.09	6.71	28.36
dep_healthidx	11.34	33.21	12.16	46.28
dep_disability	12.38	23.89	9.28	36.30
dep_obesity	14.96	30.11	15.07	36.00
dep_housecond	1.59	10.85	4.83	8.05
dep_overcrowded	4.21	18.22	11.87	10.93
dep_hhfacilities	1.19	5.81	3.76	5.91
dep_matdep	9.11	77.34	34.74	49.97
dep_wealth	15.85	83.90	40.11	69.90
dep_actindex	18.68	63.38	22.96	69.46
dep_meetfriends	18.75	47.38	19.90	55.12
dep_unemp	1.67	43.82	4.67	24.44
dep_underemp	4.89	8.12	7.55	7.24
dep_precemp	5.15	8.10	8.80	8.48
Age				
<25	8.03	8.23	20.54	6.02
25–30	6.75	7.55	10.01	4.83
31–39	15.47	13.25	11.87	11.62
40–49	20.32	21.07	15.86	15.55
50–59	16.44	23.25	13.16	19.95
60–69	15.58	14.43	12.08	17.86
70+	17.41	12.21	16.49	24.17
Wealth				
House owner[a]	42.96	7.76	24.48	11.92
Car owner	87.81	39.12	63.78	59.85
Counting vector	9.68	44.79	16.64	40.01
N	40537	1881	3075	2617

Data from SOEP v29.1. ; Cells contains percentages; underlying *k*-cutoff is 33%, income-poverty cutoff is 60%.

[a] Not asked in 2006/07

deprivation, nor is indicated to inaccurately reflect material well-being, it may point to incorrectly ignored poor persons.

5.6 Interim conclusions

The lack-of-income dimension is abandoned for both conceptual and empirical grounds. First, social participation, a key dimension income is important for, is directly implemented. This also extends to material deprivation, which is related more directly to deprivations in other functionings (economic security and practical reason). Third, there is evidence for extensive double-counting as ca. 75% of the income-poor are also deprived in at least one material deprivation indicators. Moreover, the slightly higher deprivation count of IO-poor is substantially driven by

material deprivation indicators, and thus weakening the concern for the IO-poor to be truly multiply deprived. Finally, for a significant share of the IO-poor (20%), income seems to inaccurately reflect their material well-being.

6 Concluding remarks

Instead of another summary, I conclude with some final remarks. Several of the results, the present study finds, are independent of the underlying poverty cutoff k. For instance, poverty unambiguously rises during the first half of the decade, as it falls during the second half. In contrast, whether poverty ultimately stands at a higher level at the end of the decade, depends on k. As defining k is inevitably a normative exercise, it can neither be solved solely within academia, nor can it be purely chosen to obtain a "reasonable" poverty headcount. Instead, setting the poverty cutoff must draw on the public debate, for which it is crucial that the cutoff can be expressed in semantic meaningful terms (e.g., being poor requires full deprivation in at least two dimensions). Although the present study frequently uses $k = 33$, this is most likely a lower bound. Targeting individuals where deprivations are most interwoven, may suggest stricter cutoffs. While stricter cutoffs are normatively more forcing, lower cutoffs may imply headcount ratios too high to be useful. However, introducing more convincing poverty measures may, on their part, also help to objectify the public debate on poverty—especially in advanced economies like Germany.

The next steps towards a multidimensional poverty index for Germany should explore the options for direct implementations of missing dimensions such as such as agency, self-respect, security, practical reason and appearance in public without shame. Currently, complex functionings like these are only captured indirectly. Research on direct implementations is under way (Alkire 2007). Additionally, a clear conceptual account of both employment and time is needed for a better integration of deprivations related to them. The integration of time-related aspects is, though complex, in progress (e.g., Merz and Rathjen 2014). Implemented dimensions might be slightly refined as well. *Social participation*, for instance, could be complemented with questions on Internet-based activities.

Table 9 Wealth by income-poverty status and material deprivation

	Not income-poor		Income-poor	
	No mat. dep.	Mat. dep.	No mat. dep.	Mat. dep.
House owner	49.38	7.48	46.63	7.44
Car owner	87.41	73.80	72.28	45.10
Wealth > 7.000 EUR	87.37	34.53	78.26	19.57
Median net wealth	105.00	0.00	66.02	0.00

Data SOEP v29.1, House ownership not asked in 2006/07, more detailed wealth information not asked in 2011/2012; cells contain percentages; median of wealth in 1.000 EUR. Materially deprived means according to at least one indicator

Table 10 Partitioning the income-poor

	No wealth		Wealth		Total
	No mat. dep.	Mat. dep.	No mat. dep.	Mat. dep.	
Both-poor	0.53	34.36	1.48	4.66	41.02
IO-poor	4.84	25.28	19.00	9.86	58.98
Total	5.37	59.64	20.48	14.51	100.00

Data SOEP v29.1, waves 2001/02 and 2006/07. Materially deprived means according to at least one indicator, cells contain pecentages

Importantly, some groups currently ignored, must be taken adequately into account. While homeless people are not covered by the underlying data, children, in contrast, are deliberately excluded, since accurately capturing their well-being requires a distinct specification. Taking these groups into due consideration is of highest significance. Moreover, given the current data, a more careful analysis of shocks (e.g., of the financial crisis) and reforms (e.g., of the labour market regulations) is difficult, since the poverty measure cannot be computed on a yearly basis. Assuming a consensus on the indicators, this is, however, straight forward to fix. Similarly, accounting for confounding factors would deepen the analysis and help to uncover the mechanism behind multidimensional poverty.

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Appendix

See Table 11.

Table 11 Questions

Activities
Which of the following activities do you take part in during your free time? Please check off how often you do each activity: at least once a week, at least once a month, less often, never
Going to the movies, pop music concerts, dancing, disco, sports events
Going to cultural events (such as concerts, theater, lectures, etc.)
Doing sports yourself
Volunteer work in clubs or social services
Attending church, religious events
Meeting with friends, relatives or neighbors
Helping out friends, relatives or neighbors

References

Alkire S (2007) The missing dimensions of poverty data: introduction to the special issue. Oxf Dev Stud 35(4):347–359

Alkire S (2009) The capability approach as a development paradigm? In: Chiappero-Martinetti E (ed) Debating global society: reach and limits of the capability approach, chap 1. Fondazione Giangiacomo Feltrinelli, Milan, pp 31–60

Alkire S, Apablaza M (2016) Multidimensional poverty in Europe 2006–2012: illustrating a methodology. OPHI working paper 74, Oxford Poverty and Human Development Initiative (OPHI), Oxford

Alkire S, Foster J (2011) Counting and multidimensional poverty measurement. J Public Econ 95(7–8):476–487

Alkire S, Foster JE (2016) Dimensional and distributional contributions to multidimensional poverty. OPHI working paper series 100, Oxford Poverty and Human Development Initiative (OPHI), University of Oxford, Oxford

Alkire S, Santos ME (2014) Measuring acute poverty in the developing world: robustness and scope of the multidimensional poverty index. World Dev 59:251–274

Alkire S, Ballon P, Foster J, Roche JM, Santos ME, Seth S (2015) Multidimensional poverty measurement and analysis: a counting approach. Oxford University Press, Oxford

Arndt C, Volkert J (2007) A capability approach for official german poverty and wealth reports: conceptual background and first empirical results. IAW—discussion papers 27, Institut für Angewandte Wirtschaftsforschung, Tübingen

Atkinson T, Cantillon B, Marlier E, Nolan B (2002) Social indicators: the EU and social inclusion. Oxford University Press, Oxford

Bourguignon F, Chakravarty S (2003) The measurement of multidimensional poverty. J Econ Inequal 1(1):25–49

Bundesregierung (2008) Lebenslagen in Deutschland. 3. Armuts- und Reichtumsbericht. Bundesministerium für Arbeit und Soziales (BMAS), Berlin

Bundesregierung (2013) Lebenslagen in Deutschland. 4. Armuts- und Reichtumsbericht. Bundesministerium für Arbeit und Soziales (BMAS), Bonn

Busch C, Peichl A (2010) The development of multidimensional poverty in Germany 1985–2007. IZA discussion papers 4922, Institute for the Study of Labor (IZA)

Datt G (2013) Making every dimension count: multidimensional poverty without the "dual cut off". Monash economics working papers 32-13, Department of Economics, Monash University

Evans M, Kelley J, Sikora J, Treiman DJ (2010) Family scholarly culture and educational success: books and schooling in 27 nations. Res Soc Stratif Mobil 28:171–197

Foster J, Greer J, Thorbecke E (1984) A class of decomposable poverty measures. Econometrica 52(3):761–66

Frick JR, Grabka MM, Marcus J (2007) Editing and multiple imputation of item-non-response in the 2002 wealth module of the German Socio-Economic Panel (SOEP). In: SOEP papers on Multidisciplinary Panel Data Research 18, DIW Berlin, Berlin

Goebel J, Grabka MM, Krause P, Kroh M, Pischner R, Sieber I, Spieß M (2008) Mikrodaten, gewichtung und datenstruktur der längsschnittstudie sozio-oekonomisches panel (SOEP). Vierteljahrshefte zur Wirtschaftsforschung 77(3):77–109

Haisken-DeNew JP, Hahn M (2010) Panelwhiz: efficient data extraction of complex panel data sets: An example using the german SOEP. Schmollers Jahrbuch 130(4):643–654

Hetschko C, Knabe A, Schöb R (2013) Changing identity: retiring from unemployment. Econ J 124(575):149–166

Kassenböhmer SC, Haisken-DeNew JP (2009) You're fired! The causal negative effect of entry unemployment on life satisfaction. Econ J 119:448–462

Kunze L, Suppa N (2017) Bowling alone or bowling at all? The effect of unemployment on social participation. J Econ Behav Organization 133:213–235. doi:10.1016/j.jebo.2016.11.012

Leßmann O, Bonvin JM (2011) Job-satisfaction in the broader framework of the capability approach. Manag Rev 22(1):84–99

Mani A, Mullainathan S, Shafir E, Zhao J (2013) Poverty impedes cognitive function. Science 341:976–980

Marlier E, Atkinson AB (2010) Indicators of poverty and social exclusion in a global context. J Policy Anal Manag 29(2):285–304. doi:10.1002/pam.20492
Merz J, Rathjen T (2014) Time and income poverty: an interdependent multidimensional poverty approach with German time use diary data. Rev Income Wealth 60(3):450–479
Mullainathan S, Shafir E (2013) Scarcity: why having too little means so much. Allen Lane, London
Nowak D, Scheicher C (2016) Considering the extremely poor: multidimensional poverty measurement for Germany. Soc Indic Res. doi:10.1007/s11205-016-1365-7**(forthcoming)**
Nussbaum MC (2001) Women and human development: the capabilities approach, The John Robert Seeley lectures, vol 1998, 13th edn. Cambridge University Press, Cambridge
OECD (2011) How's life? OECD better life initiative, Measuring well-being. OECD Publishing, Paris
OECD (2014) Education at a Glance OECD Indicators. OECD Publishing, Paris
Ravallion M (2011) On multidimensional indices of poverty. J Econ Inequal 9(2):235–248
Rippin N (2016) Multidimensional poverty in Germany: a capability approach. Forum Soc Econ 45(2–3):230–255. doi:10.1080/07360932.2014.995199
Robeyns I (2003) An introduction to the capability approach. Technical report, University of Amsterdam, Amsterdam
Robeyns I (2011) The capability approach. In: Zalta EN (ed) The Stanford encyclopedia of philosophy. http://plato.stanford.edu/archives/sum2011/entries/capability-approach
Sen AK (1983) Poor, relatively speaking. Oxf Econ Pap 35(2):153–169. doi:10.1093/oxfordjournals.oep.a041587
Sen AK (1985) Commodities and capabilities, 12th edn. North-Holland Publishing, New Delhi
Sen AK (1992) Inequality reexamined. Russell Sage Foundation book, 3rd edn. Russell Sage Foundation, New York
Sen AK (1999a) Democracy as a universal value. J Democr 10(3):3–17
Sen AK (1999b) Development as freedom. Oxford University Press, Oxford
Sen AK (2004) Capabilities, lists and public reason: continuing the conversation. Fem Econ 10(3):77–80. doi:10.1080/1354570042000315163
Shah A, Mullainathan S, Shafir E (2012) Some consequences of having too little. Science 338(2):682–685. doi:10.1126/science.1222426
Silber J (2011) A comment on the MPI index. J Econ Inequal 9(2):479–481. doi:10.1007/s10888-011-9198-8
Slesnick DT (2001) Consumption and social welfare. Cambridge University Press, Cambridge
Stiglitz JE, Sen AK, Fitoussi JP (2009) Report by the commission on the measurement of economic performance and social progress. Technical report, Commission on the Measurement of Economic Performance and Social Progress. http://www.stiglitz-sen-fitoussi.fr
Suppa N (2015) Labor and the capability approach. Towards Conceptional Clarity. mimeo, TU Dortmund, Dortmund, presented at HDCA 2015, Washington DC
Suppa N (2016) Comparing monetary and multidimensional poverty in Germany. OPHI working paper 103, University of Oxford, Oxford
Suppa N (2017) Transitions in poverty and deprivation. OPHI working paper 109, OPHI, Oxford, UK
Townsend P (1979) Poverty in the United Kingdom: a survey of household resources and standards of living. University of California Press, California
Tsui K (2002) Multidimensional poverty indices. Soc Choice Welf 19(1):69–93
UNDP (2011) Human development report 2011: sustainability and equity: towards a better future for all. Human Development Report. Palgrave Macmillan
Wagner GG, Frick JR, Schupp J (2007) The German Socio-Economic Panel Study (SOEP): scope, evolution and enhancements. Schmollers Jahrbuch 127(1):139–169
Whelan CT, Nolan B, Maître B (2014) Multidimensional poverty measurement in europe: an application of the adjusted headcount approach. J Eur Soc Policy 24:183–197
WHO (2000) Obesity: preventing and managing the global epidemic. No. 894 in World Health Organization technical report series, World Health Organization, Geneva
Wissenschaftszentrum Berlin für Sozialforschung (WZB), Institut für Arbeitsmarkt- und Berufsforschung (IAB) (2013) Soziale Mobilität, Ursachen für Auf- und Abstiege. on behalf of BMAS (ed.), Bonn
Wolff J, de Shalit A (2007) Disadvantage, Oxford political theory. Oxford University Press, Oxford