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Explaining changes in poverty rates. A methodological framework with an application to Germany.

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Abstract: The article discusses unconditional quantile regression as an instrument of multivariate analyses of poverty rates. Using data from the German Socio-economic Panel (GSOEP), the authors discuss in what way different types of private households and other variables have contributed to the rise and fall of the 10^{th} and 50^{th} percentile of the income distribution between 1992 and 2011, resulting in increases and decreases of the relative income poverty rate. Social security pensions and demographic factors strongly muted the increase of poverty rates whereas young households, zero earners and parttimers contributed to growing poverty. Disentangling contradictory effects at different quantiles of the income distribution, it becomes clear that so far, the rise of poverty has hit only the tip of an iceberg.

1. The increase of relative income poverty

In the past decades OECD countries have experienced poverty increases (Pisu 2012). The patterns of changes vary strongly. In this article we offer a methodological framework which enables scholars in depths analysis of processes underlying changing poverty rates. We show how this framework contributes to a deeper understanding of changes in poverty rates with an application to Germany. This framework allows scholars to analyze changes in poverty rates leading to a better understanding why they changed differently across OECD countries.

Germany has been experiencing an increase of relative income poverty from about 7 to 10% of all inhabitants. The rate has remained more or less stable since the *German jobwunder* started in 2005 - contrary to an expected fall in the face of a significant increase of employment (Grabka and Goebel, 2013). Are more jobs no longer sufficient to lower the rate? Or is the poverty rate no longer influenced by wages but rather by unfavorable demographic developments like an increased number of one-person households? Could there be overlapping processes - e.g. due to off-setting taxes and transfers – which would seem to lower or raise the rate so that apparently there has been no measurable change since 2005 despite a considerably lower level of unemployment?

Available analyses do not offer a clear response to the questions raised. Existing explanations are often based on the examination of group-specific rates and the development of the respective population shares (Bönke et al., 2012; Grabka and Frick,

2010). Some studies present logistic regressions to reveal which aspects make poverty more probable (Grabka and Frick, 2010: 9; Bönke and Schröder, 2011). However, logistic regressions are not suitable for revealing the causes of increased poverty *rates* (Biewen and Jenkins, 2005: 332). *Shift-share* analyses break down changes in the rate according to the poverty risk of groups and their relative share of the population (OECD, 2008: ch. 5). Sequential decompositions of inequality measures (Arndt et al., 2011, Biewen and Juhasz, 2012), proposed within the government's reports on poverty and wealth, allow for a multivariate estimation of the impact of individual dimensions. However, their results are path-dependent, i.e. sensitive to the order in which variables enter the decomposition so that effect sizes of individual variables remain uncertain (see also Azevedo et al., 2013).

To avoid such problems, we will present a simple decomposition based on unconditional quantile regression (Firpo et al., 2009). In section 2, we will lay down which processes need discussion in this framework and which influences are to be expected in Germany. After a presentation of data and variables, we will explain why the *decomposition of unconditional quantile regressions* is a suitable instrument for our aim (3). Results (4) show that the recent rise of the rate is predominantly caused by the labor market while one-person households unexpectedly even relieve the rate. Germany's relative income poverty rate would be *significantly* higher, however, if it was not relieved by important composition effects and had the federal subsidy to the German statutory pension insurance scheme (Deutsche Rentenversicherung) not been drastically extended. Beyond that subsidy public redistributions contribute comparatively little to lowering the rate. We will conclude with a cautious outlook on possible future trends (5).

2. The decomposition of poverty rate increases

2.1 Poverty rate, conditional poverty risk, and composition effects

The share of households below the relative income poverty line may rise for several, albeit different reasons:

1) As the conditional poverty risk increases for one household type, e.g. young households or pensioners, the overall poverty rate increases with otherwise stable boundary conditions, because this type feeds more households into the population living in poverty. The poverty risk of a group may increase as its economic situation deteriorates. Only in this case and

given that no other changes have occurred could the increased poverty risk of this group explain the increase of overall poverty.

The poverty risk of a group may also increase if for example households with middle incomes improve economically over time. This relative improvement could possibly shift the median, thus the poverty line, and eventually the poverty rate upwards. Such influences on different parts of the income distribution based on changes in the relative economic situation of household types will hereafter be referred to as *income structure effects*.

2) Assuming that a household's poverty risk remains stable over time but the relative population frequency of this household type increases, the overall poverty rate would increase as well because this group feeds more observations into the poverty population. Processes not relevant to the relative poverty risk of a group may thus be another reason for an increased poverty rate. These influences will hereafter be referred to as *composition effect.*

3) Income structure effects and composition effects may show complex interrelations. Bönke et al. (2012: 189) find that the poverty risk is increasing for young German households, while their respective relative group frequencies are decreasing. In this case, the increased poverty risk for young people does not necessarily result in an increase of poverty rates (Biewen and Jenkins, 2005: 332). The decrease of the relative frequency for this household type could even lead to a *lower* contribution of young households to the poverty rate *despite* their increased conditional poverty risk.

2.2 Widening and compressing the lower half of the income distribution

Thus, for an explanation of increased poverty rates, *firstly* the influence of different household types on specific parts of the income distribution has to be established and their respective contribution to the poverty rate has to be estimated. In what follows, we will only apply an analysis of influences specific to the 10^{th} percentile and the median of the entire income distribution. The 10^{th} percentile separates the lower 10% of all observations from the other 90%, in Germany approximately marking the relative income poverty threshold usually defined as 50% of the median of net equivalized household income.[1] A parallel examination of both quantiles is essential as *both* points are subject to non-parallel changes over time within the total income distribution. The poverty rate increases as the distance between lower and middle incomes increases. If they converge over time the income distribution will be compressed and the rate decreases. We examine movements of

both the 10th percentile and the median to record a widening or, alternatively, compressions of the lower part of the income distribution over time. To this means, an applicable procedure must capture the simultaneous influence of household types and additional variables for several quantiles of the *total* (unconditional) income distribution. This first part of the analysis is achieved through an estimation of *unconditional quantile regressions* for the median and the 10th percentile. The examination of the 10th percentile alone would lead to inappropriate conclusions as it would provide no information on widened or compressed lower income ranges. If we assume that the lower range of the income distribution is extremely compressed and the lower 10% of all households are very close to the median, the poverty rate will be very low *due to*, among others, the distance between the 10th percentile *and the median* being very small. Without the relation to the median, an analysis of the lower quantiles thus does not provide answers to the questions raised initially.

Secondly, the procedure must separate effects of subgroups on quantiles of the total distribution into income structure effects and composition effects, because not only group-specific poverty risks but also the relative population shares of household types have changed to a surprising extent in recent decades (Bönke et al., 2012, Peichl et al., 2012, Grabka and Frick, 2010). As income and composition changes influence both quantiles of interest here, we submit four processes each prone to individual impacts on the overall poverty rate. In this *second* step, the change in poverty rates is thus ascribed to *two* separate processes at *two* different points of the distribution. An Oaxaca-Blinder-type decomposition will disentangle those two types of household-specific effects on both quantiles estimated in the first step.

2.3 The impact of different household types on the poverty rate

This paragraph will introduce hypotheses on possible income structure effects and composition effects in Germany. Table 1 provides an overview of the directions we predict for the respective impacts.

[Table 1]

Pensioners, especially in Eastern Germany, have experienced a significantly improved situation since reunification. The pension level in Eastern Germany was adjusted to the

Western level with large steps at first, then gradually. The federal subsidy to the German statutory pension insurance scheme has been drastically increased during the past twenty years. Several additional regulations were created, among others for widows, substitute periods, and emigrants (Kortmann and Heckmann, 2012). Pension policies targeted pensioners in lower income ranges (widows and Eastern Germans). Furthermore, there is an increase of pensioners with income from occupational pensions as well as early retired persons. Also, the share of re-employed pensioners is increasing steadily. The relative share of pensioner households of the total population has increased comparatively little so far because most baby boomers will only reach retirement age within the next years. We thus expect a significantly negative income structure effect thus lowering poverty rates, and a moderately negative composition effect.

Young households are increasingly considered at risk of poverty (Bönke et al., 2012). Their economic situation is characterized by tense conditions entering the labor market. The bumpy entry onto the labor market is partly compensated by a faster wage growth in middle age (Blossfeld et al., 2007). However, this does not counteract the economic deterioration of young age households. An expansion of incomes in the lower half of the income distribution is the result. Furthermore, young people become less often household head over time: *Firstly,* the generation following the baby boomers had lower birth rates. *Secondly,* employment is postponed to later stages in life, which is a consequence of educational expansion keeping young people in educational institutions for longer periods of time (Mills and Blossfeld, 2003). This "slimming-down" of lower income ranges due to a receding number of young households counteracts the above mentioned widening of lower incomes as a composition effect.

In the past 20 years, the **employment structure of private households** has changed considerably in Germany. In the following, we will classify households according to the number of persons of working age not working at all, working part-time or full-time. Households with members *of working age* (i.e. outside the group of pensioners) that have no gainful employment count as zero-earner households. For those households income mainly consists of transfers. The "Agenda 2010" has changed the distribution of public transfers fundamentally (Eichhorst et al., 2010). The period for receipt of unemployment benefit was reduced, the regulations on the adequacy of jobs for long-term unemployed persons were reinforced and the concept of the "needs community" (Bedarfsgemeinschaft) was redefined. Recipients of unemployment benefit (Arbeitslosengeld II) are quickly downgraded to basic benefits or reintegrated into the labor market faster. Overall, the

income situation has deteriorated for zero earner households (Arndt et al., 2011), especially for the long-term unemployed, which should widen the distribution of incomes in the lower part and increase the poverty rate. Despite strong increases of employment rates, Germany still reports a high number of **zero-earner** households. We therefore assume a widening income structure effect and no or insignificant composition effect for this household type.

As households with one or more **part-time earners** are highly at risk of poverty, their increased frequency implies an increased number of households in the lower ranks of the income distribution. This compresses the lower and average ranks of the income distribution, while the lower ranks are expected to be affected more strongly. The trend towards more households with part-time employment should therefore result in a widening of lower and middle incomes and thus in a higher poverty rate (Lohmann, 2010) as poverty is not compensated by employment within the household context in this case. As part-time work, mini jobs, and other nonstandard forms of employment are often low-paid, we moreover expect a decrease of the economic situation for those households. In addition to a positive income structure effect, they thus also experience a positive composition effect.

As the number of households with **little professional experience in full-time** (<6 years) of working age is increasing and little professional experience at this point equals depressed wages, we expect positive composition and income structure effects which increase the poverty rate. An analogous expansion of lower income ranges is expected for households with **extensive professional experience** in full-time.

The **expansion of education** has increased educational levels of which women benefitted in particular. While the relative share of household heads with low educational background is decreasing, the share of those with academic degree is increasing. As the first group is concentrated in lower income ranges, its decrease should result in a compression of the lower half of the distribution. Contrarily, academics are spreading over the income distribution heterogeneously. However, the increase of this group should tend to have a higher influence on the average and upper ranges of the distribution than on the lower ones, which should result in a widening of incomes. Simultaneously, opportunities on the labor market are decreasing for persons with a low level of education while they are increasing for academics. This should also add to a widening of the bottom half.

Female employment rates have been increasing continuously. Changed attitudes leading to a higher number of single mothers and women also resulted in an increasing number of households with **women as head of household**. Simultaneously, opportunities increased

for well-educated women on the labor market, with wage inequality increasing more significantly *between* women than men (Haupt, 2013). On average, women still earn less income than men so that the number of female headed households with low income is increasing, which should raise the poverty rate. At the same time, however, the income distribution should rise from the lower ranges for women due to their increased level of education. This should affect middle incomes more than lower incomes, which will also lead to a general increase in poverty rates.

The effects of **taxes, social security contributions, and transfers** on the distribution of household incomes are essential to the explanation of increased poverty rates, whereby a statement on expectations concerning the direction of individual effects is difficult (Andreß and Seeck, 2007: 468). Both the large extent to which the state redistributes incomes and the manifold reforms during the period considered demand the examination of effects which the entire redistribution system may have on the poverty rate. It has been suggested that more recent changes, especially the tax reforms issued by the Schröder government and the Agenda 2010, but also insufficiently adapted transfers (e.g. housing benefits) may have contributed to an increase of the poverty rate (Burkhardt et al., 2012, Arndt et al., 2011). At the same time, reforms can be detected for the period considered that should have caused a compression of the income distribution in the lower half. This applies in particular to the expansion of tax exempted minimum income (see Bach et al., 2013). Expectations are more difficult concerning reduced social security contributions for new mini and midi jobs as these jobs are not concentrated in the lower income ranges but are spread across the entire distribution (Klenner and Schmidt, 2012: 16). At the same time, transfers concerning family policies, especially child and parental benefits, were vastly extended or implemented. If and to what extent these extended transfers actually cause a stronger compression of incomes than in the beginning of the 1990s can only be determined empirically; one needs to keep in mind that children and families as recipients of these benefits are only concentrated in the lowest income ranges when three or more children are included, which is only applicable to a by now very small share of all households (Bönke et al., 2012: 184, Grabka and Frick, 2010: 6). Therefore the effect on the 10^{th} percentile and the median of the total distribution has to be verified separately for *firstly* taxes and social security contributions and *secondly* for public transfers.

The increased frequency of **one-person and divorced households** is often assumed to increase the poverty rate. Respective composition effects are thus expected. However,

there are no clear research results justifying the assumption of an analogous income structure effect, hence no expectations will be phrased to this extent.

3. Data, variables & methods

3.1 Data

For our analysis we are using the waves 1992-1994 and 2009-2011 of the *German Socio-economic Panel* (GSOEP). We are pooling the waves 1992-1994 and 2009-2011 to increase the quality of the model estimation (Biewen and Juhasz, 2012). Estimations of effects – especially at the margins of distribution – could be influenced by a few individual observations within one wave. This may particularly be an issue concerning the density estimations in the lower ranges which are essential for the model estimations (see technical appendix A3.2). The waves were chosen to enable the observation of unified Germany over a large period of time.

3.2 Variables

Our analysis is based on the log net household equivalent income taken from the *Cross-National Equivalent File* (CNEF, see Frick et al., 2007, including imputed rents) deflated to 2005. We are using the OECD equivalence scale, which calculates a weight of 1 for the head of household, 0.5 for every additional member of the household older than 14 years and 0.3 for all members younger than 14 years. The deflation of incomes is based on the consumer price index proposed in the CNEF. For dependent variables, we are not using net household equivalence incomes but the recentered influence functions (RIF) of the median and the 10^{th} percentile of this distribution (see technical appendix A3.2).

All independent variables refer to either the household structure or the characteristics of the household head: A household is considered a pensioners-household if its head is a pensioner and at least 60 years of age. A young household is defined by a head younger than 29 years of age. Additional variables take into consideration gender, immigrant background (German/non-German) and marital status (divorced/not divorced) as well as the educational background of the household head. The educational background differentiates household heads with a low level of education (ISCED 1-2), an average level of education (ISCED 3-5) and a high level of education (ISCED 6). This operationalisation stems from the much-discussed assumption that the polarization of wages and incomes is

caused by technological developments. We distinguish households according to their labor market position: A household is considered a zero-earner household if no member of working age reports labor income. Part-time households have an earned income from only one or more part-time job/s, with the total work time volume remaining lower than 85% of a full-time position. Additionally, we differentiate between households with 1-1.5 earners and two or more full-time earners. A low level of professional experience applies if the members of the household of working age accumulate less than 6 years of full-time work in total; average professional experience applies for 6 up to 20 years. Extensive professional experience, however, implies 20 or more years. Variables for taxes, social security contributions and public transfers also derive from the CNEF.

3.3 Methods

The method we are applying differs from usual regression models in many respects (3.3.1). In section 3.3.2, the decomposition is discussed. Appendix A introduces the technical details of the method (see also Fortin et al., 2011, Firpo et al., 2009).

3.3.1 Conditional and unconditional quantile regressions

OLS regressions are not suitable for multivariate analyses of changes in poverty rates, because they examine the average value of the total distribution instead of the quantiles relevant to the poverty rate (the median and the percentiles in the lower ranges). At first glance, quantile regressions developed by Koenker and Basset (1978) could be deemed a suitable tool for a multivariate analysis of poverty rates. However, these *conditional* quantile regressions do not allow an *unconditional* interpretation of coefficients. In the following, we will thus introduce *unconditional* quantile regressions (see Killewald and Bearak, 2014).

The idea of conditional quantile regressions is to divide a distribution into quantiles for *each subgroup*. The aim of the analysis is to compare different values for the same quantiles according to different subgroups. If, for example, the analysis aims at gender differences regarding high incomes, like the 90^{th} percentile, this regression provides answers to the question: How high does the minimum income have to be for a man or woman to belong to the upper 10% of the distribution *with respect to their own sex*? As the incomes of men and women still differ, this threshold is lower for women than for men. The regression coefficient thus marks the additional income a man has to earn compared to a woman to belong to the upper 10% of the income distribution of *his group*.

The difference of the respective limits is not equivalent to the contribution of a group to the location of the limit for the entire upper 10%. This statement is best visualized applying a longitudinal perspective with the arguments on poverty risk and poverty rates presented in 2.1.

Assuming that the female share of the population increases over time but the distribution of incomes remains the same, the (conditional) quantile differences regarding gender will *not* change, because this would require a change of location of the quantile. This alone, however, could not change the group size, as quantiles are always defined by *relative frequencies*. However, increasing the relative share of women would have an impact on the situation of the *unconditional* quantiles. If women continue to earn significantly less, the *unconditional* distribution is shifted slightly to the left, i.e. into the lower incomes, due to the higher frequency of women's incomes compared to men's. This can affect the values of all unconditional quantiles, *despite* the *conditional* quantile differences regarding gender having remained stable over time.

A second reason not to equate impacts on *unconditional* quantiles with *conditional* quantile differences is the complex connection possible between a change in location of a conditional distribution and the relative share of the observed group within the population. It is possible, for example, that families with children have increasingly higher incomes over time due to family transfers, while their relative frequency within the population decreases. In this case, the quantile difference between the family and non-family households changes over time, but this economic improvement does not necessarily shift the total distribution towards the top, if for example the relative improvement for families is compensated by their decreased frequency. An economic improvement for families might thus not have an impact on the *unconditional* distribution, *despite* an increasing quantile difference to the similar group.

This point exactly marks the traditional problem in the multivariate analysis of poverty rate differentials. Group risks and group frequencies are known, but it cannot be estimated which groups contribute to poverty rates to what extent concerning which changes. This traditional difficulty with estimating impacts of groups on unconditional quantiles has in the meantime been solved by a regression method developed by Firpo et al. (2009). It allows the estimation of the impact of characteristics on the location of *unconditional* quantiles.

Its basic idea is that each observation has a more or less strong impact on the estimation. Identifications of outliers are based on this assumption in common model diagnostics. An observation is often denoted as an outlier if its impact on the estimation result ranges above a defined limit. In robust statistics, a method to determine the impact of each observation on the estimation result was developed using, amongst others, the concept of *influence functions* (Andersen, 2008: 8). The impact of an observation is determined by duplicating the observation in the sample. Concerning quantiles, theoretically, one single duplicated observation can only increase the relative share below or above the quantile by a marginal part. If the observation is located below the quantile, it increases the relative share below the limit. The quantile thus *has to* shift towards the bottom to comprise the relative share of the distribution defined by the observation. A duplication of an observation below a quantile limit therefore lowers the quantile. Same applies vice versa for observations above the quantile limit.

While the analysis of individual observations is relevant for model diagnostics, we are interested in the impact groups have on the location of quantiles – e.g. due to the much-discussed claim that the increase in poverty rates is caused to a considerable extent by the increased frequency of single person households. Depending on how often observations are located above or below the quantile within the group, the group shifts the location of the quantile counterfactually - or comparing different points in time – towards the bottom or the top. Unconditional quantile regressions can thus be understood as analysis of the lifting or lowering of quantiles *by subgroups*. Over time, it can be observed which groups shift certain spots of the distribution further to the top or the bottom. It can also be examined if, and in which direction, the impacts of the observed groups on the total distribution partially or completely nullify each other.

3.3.2 Decomposition of unconditional quantile regressions

As explained in section 2.1, a group can influence unconditional quantiles through economic changes and changes of its population frequency. Both changes are registered as changes of the average value. If certain households for example receive an increasing amount of transfer income over time, the average of this variable will increase. This change of characteristics can, however, be attributed to a change in relative frequencies: The average of transfers only increases because the relative share of households with high transfers as opposed to households with low transfers increases. Ultimately, a composition effect can thus always be understood as change through relative frequencies.

However, estimations of unconditional quantile regressions are not sufficient for a deeper understanding of the change in poverty rates. An estimated background of a group at a quantile could be due to an overlap of a positive composition effect and a negative income structure effect – or vice versa - at this spot.

The impact of a group on the location of a spot on a distribution may thus occur for two very different reasons which have to be distinguished. In what follows, this problem will be solved with the decomposition developed by Oaxaca and Blinder (Oaxaca 1973, Blinder 1973, Jann, 2008). This decomposition demands that coefficients be interpretable unconditionally, which is not possible for conditional quantile regressions (see Fortin et al., 2011: 8f., Annex A3.1).

Our analysis thus occurs in three steps: We estimate unconditional quantile regressions for each point of time for the median and the 10^{th} percentile. The sum of all estimates for the median and the 10^{th} percentile equals at every point of time an estimation of the location of the respective spot. The difference estimated between the two points of time equals the estimated shift of the median and the 10^{th} percentile. As this shift is constituted by household impacts which are respectively based on composition and income structure effects, counterfactual shifts can be deduced: To what extent would for example the median have shifted if pensioner households had not improved economically between the two points of time? To what extent would the 10^{th} percentile have shifted if the relative population frequency of young households had remained stable over time?

As we are pooling several waves, household clusters result from different waves, requiring a correction of standard errors of the estimation. The reported standard errors derive from a bootstrap with 1000 replications. As households are picked randomly for the bootstrap and the households are weighted differently, the weights have to be included in the replication. We use the STATA-ado oaxaca8 (Jann, 2008).

4. Results

Changes of relative group frequencies in the population have a significant impact on possible composition effects; therefore table 2 reports some of the changes together with group-specific poverty risks (i.e. the relative frequency of poverty risk within groups according to the GSOEP). Even though the literature usually reports poverty risks and population shares according to *personal* characteristics, table 2 refers to *households*

because subsequent multivariate analyses only make sense if applied at the household level.

[Table 2]

Table 3 shows results of the decomposition of quantile regressions on the 10th percentile and the median of the distribution of real net equivalent household incomes. Incomes fell by 1.8% at the 10th percentile between 1992/4 and 2009/11, whereas the median increased by 5.9%. This new income gap to be explained is constituted by a sum of overlapping effects. Columns 5 and 6 add up the respective income structure and composition effects on the 10th percentile with the effects on the median and determine the resulting net effect as *percentage* of the total, newly developed gap. We thus have a new net gap in the annual income of 1155 Euro which represents increased poverty rates. The coefficients in columns 1-4 each present counterfactual scenarios: How high would the value of the 10th percentile or the median be if there had only been either the respective composition or the income structure effect? As, however, the *relation* of the effects on the 10th percentile and the median is the important factor for the increase in poverty rates, we report a sum expressing this relation in columns 5 and 6: The effects reported there can be understood as the percentage change of the new income gap caused by the respective variable as composition or structure effects. The percentages shown in columns 5 and 6 thus express to what extent the reported coefficients generated or reduced this distance in relation to the total, newly developed gap, hence shifting the poverty rate. Negative coefficients in columns 5 and 6 represent a widening, positive coefficients a compression of the lower income ranges. These sums will therefore be used for the following discussion.

To make the procedure comprehensible, we will elaborate on the first example: For the group of pensioners, table 3 shows a positive income structure effect of 10.39% on the 10th percentile (column 3, "pensioners"). It refers to the quantile income of 9208 Euro (column 1, "income 1992/94") and equals a counterfactual increase of incomes by approx. 957 Euro (10.39% of 10424). In contrast, the analogous estimation for the median shows a positive effect of only 3.89% (column 4) referring to the median income of 16887 Euro (column 1), thus equaling a counterfactual increase of the median by approx. 358 Euro. If these two positive effects are offset, a partial counterfactual improvement of the 10th percentile of 957-358=599 Euro remains, which equals the 46% share of the total, newly developed income gap of 1155 Euro shown in column 6. Same applies to all reported effects in

columns 5 and 6.

Hypothesis 1 is thus only supported concerning income structure effects, not regarding the expected composition effects of **pensioners**.

[Table 3]

The increased poverty risk of **young households,** resulting in an income structure effect of 18%, is completely nullified by a favorable composition effect (+18%, hypothesis 2). Favorable composition effects for young households should mostly be due to demographics, but could also be a reaction to unstable labor markets delaying the foundation of independent households (Mills and Blossfeld, 2003).

As expected in hypotheses 1 and 2, developments at the 10th percentile have considerably relieved the poverty rate. Both the low number of young households and the improvement for old households are counterfactually lowering the poverty rate.

In contrast, characteristics of the labor market entail significant income losses. Income structure effects (-17%) and composition effects (-23%) for **zero-earner households** make up a total of 40% of the new gap and support hypothesis 3.1. Not only unemployment but also unstable careers, low wages, and the transition to a workfare model have had a negative impact on private households during the past two decades. Employment with one or more **part-time** earners widens the lower half of the income distribution significantly. Composition and structure effects of zero-earner and part-time households make up a total of 64%, thus the majority of the new income gap. In comparison, there have been no significant changes for **double earner households** in the lower income range. Extensive and little professional experience *in full-time* add to the image of dominating labor market risks.

The number of household heads with a low level of **education** is decreasing over time which shifts the 10^{th} percentile and the median slightly upwards. This gain, however, is nullified by income structure effects, overall leading to little change. Composition effects of academic households can be ascribed to the increased frequency of this household type in the lower range of incomes. Their relative frequency, however, has increased more significantly in the average and higher ranges than in the lower ranges, which overall leads to a polarization between average and low incomes. The models also show a higher income

structure effect on the median than on the 10th percentile. Those households thus elevate the average of the distribution and increase the poverty rate.

Over time, **women** are becoming household heads more often. While the resulting composition effects are insignificant, column 4 shows a considerable income structure effect on the median. Female household heads have thus improved over time. This improvement is more pronounced at the lower ranges of the distribution. Unexpectedly, this sums up to smaller income distances (hypothesis 5).

Coefficients of public redistribution transfers account for modest compressions. Our models show relatively small composition effects and stronger income structure effects for **transfers** on both quantiles. Overall, all four effects result in a significantly *compressing* impact of the newly developed gap on the quantiles. Transfer costs, which - according to GSOEP data - have increased by nearly 250% *overall* (i.e. for all households) between the two points of time not only shift lower ranges, but also to a significant extent middle ranges of the total distribution, where most families are situated. Public transfers are now spreading over the entire distribution on an increased level.

Vice versa, taxes and social security contributions are causing a visible income compression with a notably strong, negative income structure effect on the median. The increased social security contributions in particular have lowered the median as the share of earned incomes fully charged with contributions of total incomes is amongst the highest there. This - in comparison to the lower ranges of the distribution - increased load of contributions is made plausible, despite stable or partly even lowered contribution rates, by the strong raises of the contribution assessment ceiling according to the *average* wage increase (and even stronger, especially in the 1990s). This scale caused for example this limit for the pension insurance between 1992 and 2011 to increase by a *real* 18%. It represents the development of net household incomes in the worst imaginable manner and results in an unintended, significant compression of the lower half of the German income distribution.

5. Discussion and conclusion

Within this article we offer a methodological framework to study changes in poverty rates. Our decomposition of quantile regressions evokes a problematic impression of recent poverty increases in Germany because these have been muted significantly by demographic factors and subsidies to the German statutory pension insurance scheme. It is questionable whether these compensations of the past two decades can be continued in this form in the future. Our decomposition implies that labor market characteristics cause the largest share of the new income gap. In contrast, even the contribution of divorces is comparatively small. The German poverty rate was primarily increased by unemployment, unstable employment, part-time and low-paid positions.

To summarize, our results suggest the following interpretation: During the 1990s, poverty rates increased only slowly because new labor market pressures were largely compensated by vastly increasing public redistributions and especially by the growing subsidy to the pension scheme. However, the strong redistribution effect of the pension scheme reached its top at the end of the 1990s and has since decreased. Simultaneously, the labor market has deteriorated drastically with the crisis at the beginning of the new millennium until 2005. The result was a rapidly increasing poverty rate from 1999 until 2005, as this *comprehensive* trend was not met by further compensations. Since around 2005, however, compensations have switched roles: Increasing employment is probably dampening poverty while the group of poor pensioners is growing again. The poverty rate has thus remained more or less stable since 2005.

Future extensions of the presented methodological framework include cross-country analyses of changes in poverty rates. We believe that decompositions of unconditional quantile regressions may contribute fruitfully to knowledge about poverty trends.

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Endnotes

[1]These results are robust to alternative percentiles (i.e. the 11^{th} or 15^{th} or 18^{th}).

Tables

Table 1: Hypotheses and expected effects on the poverty rate

Hypothesis: type of household/variable	income structure effect[a]	composition effect
H1: head of household is retired	-	-
H2: young household	+	-
H3.1: no earner household	+	+
H3.2: parttime earner household	+	+
H3.3: households with extensive full-time experience	+	+
H3.4: households with little full-time experience	+	+
H4.1: head of household with low level of education	+	-
H4.2: head of household with high level of education	+	+
H5: woman as head of household	+	+
H6.1: taxes/social security	?	?
H6.2: transfers	?	?
H7: one-person households	+	?
H8: divorced	+	?

[a] + = increases poverty rate, - = decreases poverty rate, ? = contradictory expectations

Table 2: Means and poverty risks of household characteristics in 1992/94 & 2009/11 (weighted)

	Mean		poverty risk	
	1992/94	2009/11	1992/94	2009/11
pensioners	0.291	0.315	0.111	0.085
young household	0.115	0.061	0.133	0.329
Labor market position				
no earner	0.036	0.048	0.387	0.606
part-time earner	0.113	0.142	0.196	0.243
1-1,5 earner	0.443	0.438	0.015	0.021
2 full-time earners	0.129	0.103	0.003	0.001
little full-time experience	0.477	0.513	0.172	0.303
extensive full-time experience	0.291	0.306	0.006	0.010
education of head of household				
low level of education	0.218	0.145	0.130	0.195
high level of education	0.150	0.218	0.028	0.034
woman as head of household	0.419	0.464	0.121	0.118
redistribution				
Transfers	930	2.043		
taxes/social security	9.368	9.960		
control variables				
one-person household	0.351	0.406	0.132	0.154
couple without children	0.199	0.185	0.020	0.039
non-German	0.054	0.057	0.083	0.183
divorced/separated	0.121	0.182	0.127	0.169
Eastern Germany	0.187	0.199	0.120	0.137

Table 3: Results of the decomposition of unconditional quantile regressions on the 10th and 50th percentile for years 1992/94 and 2009/2011.

	1			2			3			4			5	6
	P10		**z**	**P50**		**z**	**P10**		**z**	**P50**		**z**	**Difference P10-P50**	
Income 1992/1994	9208			16887									(as percentage	
Income 2009/2011	9044			17878									of the entire new)	
Change (%)	-1,8			5,87									gap of 1155 Euro	
	Composition effects						Income Structure effects						Composition	Structure
Pensioner	0,53	***	(6,73)	0,35	***	(7,71)	10,39	***	(6,73)	3,89	***	(4,03)	0	46
Young household	2,24	***	(7,42)	0,39	***	(3,54)	-3,24	***	(-4,47)	-0,98	**	(-3,28)	18	-18
Labor market position (ref.: 1-1,5 earners)														
zero earner	-1,81	***	(-19,37)	-0,18	***	(-7,26)	-2,15	***	(-5,41)	-0,05	.	(-0,41)	-17	-23
part-time earner	-0,97	***	(-13,70)	-0,17	***	(-4,90)	-0,90	+	(-1,69)	0,34	.	(1,20)	-8	-16
double earner	0,15	***	(4,54)	-0,18	***	(-4,40)	-0,85	***	(-3,57)	-0,25	.	(-0,88)	5	-5
little full-time experience	-1,15	***	(-10,92)	-0,55	***	(-8,63)	-9,75	***	(-5,46)	-4,86	***	(-4,30)	-3	-21
extensive full-time experience	-0,03	.	(-1,34)	0,12	***	(5,27)	-0,16	.	(-0,25)	0,99	+	(1,65)	-3	-20
education of head (ref.: medium level)														
low level of education	1,39	***	(5,27)	0,74	***	(6,73)	-0,94	.	(-0,92)	-0,36	.	(-0,76)	2	-4
high level of education	0,58	***	(5,08)	1,40	***	(16,14)	0,41	.	(1,04)	0,82	**	(2,74)	-19	-10
woman as head of household	0,13	.	(1,46)	-0,09	+	(-1,85)	4,45	***	(3,73)	2,07	**	(2,88)	3	12
Transfers	2,31	***	(4,29)	0,52	*	(2,01)	6,25	***	(5,74)	3,25	***	(6,10)	16	11
taxes/social security	1,63	***	(11,14)	3,53	***	(21,41)	-0,39	.	(-0,38)	-3,74	*	(-2,49)	-46	63
one-person household	-0,67	***	(-5,34)	-0,06	.	(-0,89)	2,85	*	(2,31)	-0,21	.	(-0,29)	-6	36
non-German head of household	-0,08	***	(-5,71)	-0,05	***	(-9,80)	-0,74	*	(-2,45)	-0,47	***	(-3,30)	0	0
Divorced	-1,11	***	(-5,94)	-0,27	**	(-3,10)	-0,67	.	(-1,10)	-0,48	+	(-1,71)	-7	1
couple without children	-0,03	.	(-0,91)	-0,17	***	(-7,88)	1,62	**	(3,10)	-0,09	.	(-0,23)	3	20
Eastern Germany	-0,17	***	(-5,51)	-0,24	***	(-13,87)	1,73	*	(2,54)	1,90	***	(5,44)	2	-15
Constant							-10,48	**	(-2,92)	-0,70	.	(-0,22)		-104

"+ p<.1, * p<.05, ** p<.01, ***p<.001; N=51865 (1992-94: 19861, 2009-11: 32004);
Standard errors corrected for 7287 (1992-4) resp. 13905 (2009-11) household clusters; bootstrap standard errors with replication weights, 1000 repetitions