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# Intergenerational mobility of status with multiple dimensions in Germany and the United Kingdom

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# Intergenerational Mobility of Status with Multiple Dimensions in Germany and the United Kingdom

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# Non-Technical Summary

The fact that parents transmit their advantages in life to their children is well-known in society. Parents can help their children in several ways to succeed in the labour market: through an investment in education, through direct economic transfers as well as through the access to their social network. If a rich parent, not only can provide his/her children with a better education, but he/she can as well give them access to the best social networks, this could be a severe issue in terms of equity. The members of disadvantaged families would be prevented to climb the social ladder by achieving the best jobs, education attainments or whatever is intended to increase the satisfaction and well-being in terms of status.

The economic interpretation of the transmission of social status across generations is known as intergenerational mobility or social mobility. The level of intergenerational mobility has been usually observed in the economic literature as the correlation between the income level of fathers and adult sons. This study needs two fundamental premises, the first is that the individual status is unobserved and the second is that the mobility phenomenon is multidimensional. Therefore the study had the objective to propose a method to estimate intergenerational mobility that takes into account the multidimensionality of the phenomenon, and to compare the results with the standard unidimensional ones. The other contribution of the paper is to present a complete analysis of the intergenerational mobility in Germany and the United Kingdom and comment on the international ordering of the two countries in terms of mobility.

The method adopted is that of combining with a statistical technique, namely the factor analysis, the information coming from three different dimensions of the individual status: earnings, education and occupational status. The study employs longitudinal household survey data, since they are more powerful in terms of information about the dimensions of individual status. In particular the paper adopts the German Socio-Economic Panel (SOEP) dataset and the British Household Panel Survey (BHPS), currently United Kingdom Household Longitudinal Survey (UKHLS). The units of observation, as in all the intergenerational mobility studies, are fathers-adult sons pairs.

The findings indicate that there is a latent status bias, related to the lack

of information regarding the status and to the multidimensionality of the mobility phenomenon. The level of mobility decreases by about 30% when multiple dimensions are considered with respect to the mobility computed with the earnings dimension only. The interpretation of this result is that there are more layers of persistence within society that are not captured by the income indicator alone. Instead these layers are captured by an indicator that takes into account other aspects of the status of the individual, notably the occupational status and the education that he or she has attained.

Therefore, since according to different experts there is yet to be a consensus over mobility measurement, the existence and extent of the additional amount of correlation derived from the combination of dimensions suggests that it would be preferable to use a multidimensional index.

# Intergenerational mobility of status with multiple dimensions in Germany and the United Kingdom

Michele Bavaro*†

May, 2018

**Abstract**

This paper proposes a method to estimate intergenerational mobility that takes into account the multidimensionality of the phenomenon. The first premise is that status is unobserved; hence, it must be analysed through latent variable and factor analysis models. The second premise is that the transmission of economic status is a multidimensional phenomenon. The dimensions selected for the status measurement are the resources detained, the occupation performed and the level of education. The results demonstrate that the adoption of a multidimensional approach to the mobility phenomenon severely reduces the estimates of mobility with respect to the unidimensional approach. The empirical application is based on the German SOEP data and the British BHPS-UKHLS.

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# 1 Introduction

The empirical literature on intergenerational mobility is based on the correlation between the status of the parents and the status of their adult children. The higher is the correlation, the lower is the mobility. Within the economic literature there has been a long debate that was started by the seminal papers by Solon (1992) and Zimmermann (1992). This debate has mainly focused on how to best measure the aforementioned correlation, in particular to reduce the measurement error at the minimum. The discussion over the definition of status and how to best proxy it has been less pronounced.

Economic studies on intergenerational mobility mostly focus on income mobility. The income of parents is correlated with the income of adult children in order to measure the persistence of the transmission of status. Typically, other proxies have been the occupation performed, the level of education, the health status, or even IQ or ability levels[1]. Sociologists and social scientists in particular have increased the use of other status' proxies.

There are two main arguments that guide the realization of this paper, the first is that an individual's status is unobserved and composed by multiple dimensions. In the economic literature, as aforementioned, the standard was to consider the permanent income or lifetime income as the best proxy of the status. What I claim is that the issue of the unobservability of status is not only related to the lack of data observations regarding the income of individuals for their entire lifetime, but also the lack of information about other dimensions of the individual's life that are different from the resources detained. This argument was popularised by the work of the Nobel Laureate Amartya Sen and all those that follow the capabilities approach, for instance Alkire, Foster et al. who developed a new multidimensional poverty index (see Alkire et al., 2015). An analogous argument has been put forth in the past by works such as that of Goldberger (1989) as well as Clark and Cummins (2015). Clark and Cummins argue that the use of multiple dimensions to proxy individual status would induce a reduction in mobility since the

[1] For occupational mobility see Mazumder and Acosta (2015), for educational mobility see Hertz (2008), for a complete review of the different status' outcomes see Black and Devereux (2011).

'true' persistence in social status is much higher than the ones computed in the previous literature. This hypothesis was earlier pointed out by Goldberger (1989) in the conclusion of a paper written to criticize the approach taken by Becker and Tomes to the intergenerational mobility theory.

The second argument or second premise is that the mobility phenomenon itself is multidimensional. In other words the transmission of the status across generations, that is the phenomenon captured by the intergenerational mobility, is influenced by many dimensions. For instance a rich family can influence an individual's status through different channels: it can provide the son or daughter with economic help, it can direct him or her towards the best jobs or it can pay for the education costs in order to let her or him achieve the highest educational level. The contrary can take place in the case of less rich families that could be trapped into poverty and therefore be unable to invest in their children. What needs to be underlined is the fact that all the three different channels that were mentioned constitute a source of increase or decrease of intergenerational mobility; an individual with the same position in the income distribution of his father's but with an higher level of education, has to be considered as an individual that lived an upward mobility with respect to his father. The complexity in the mechanism guiding the transmission of the status was pointed out by several authors such as Raitano (2009) as well as Bowles and Gintis (2002).

Given the premises, the main goals of this paper are to propose a new method to estimate intergenerational mobility that allows for the multidimensionality of the phenomenon, to compare the findings with the standard unidimensional ones and finally to test the theoretical hypothesis regarding the error in the measurement of intergenerational status mobility. Three dimensions are chosen to be representative of the status of an individual: resources detained, occupation performed and education attained. The technique adopted to combine the dimensions is the factor analysis. The peculiarity of this technique is that it allows for the combination of the dimensions and therefore can be used to obtain two separate and continuous indicators of the status. It is important to underline that the measurement adopted is not technically but intrinsically multidimensional. Even if the correlation is computed

between two single variables that are the scores obtained as indicators for the individual status, they are indeed derived from the combination of three proxies.

This paper adopts the German Socio-Economic Panel (SOEP) dataset and the British Household Panel Survey (BHPS) now become United Kingdom Household Longitudinal Survey (UKHLS). The findings indicate that there is a latent status bias, which refers to a bias that derives from the impossibility of observing an individual's status. The direction of the bias is also defined: the addition of dimensions to the status of the individual reduces mobility. The interpretation of this result is straightforward; there are more layers of persistence within society that are not captured by income indicator alone. Instead these layers are captured by an indicator that takes into account other aspects of the status of the individual, notably the occupation that he or she performs and the education that he or she has attained.

The second contribution of the paper relates to the literature of intergenerational mobility of earnings and in particular the international rankings of two major European countries, namely Germany and the United Kingdom. The two similar data sources and the sample selection rules adopted allows for a reliable comparison between the estimates of mobility of the two countries. Moreover this is the first study that provides an estimate of intergenerational elasticity and correlation for the United Kingdom using the BHPS-UKHLS dataset.

The structure of the paper is as follows. Section 2 presents a short review of the literature on mobility measurement and illustrates the methodology adopted. Section 3 describes the data and the sample. Section 4 displays and comments the results and finally Section 5 presents the conclusions.

## 2 Mobility measurement

It is well-known within the mobility measurement literature that there is no consensus over the best way of measuring mobility (as argued by Jäntti and Jenkins [2013]). What is in the availability of the researcher is a portfolio of measurements that differ by mobility concept and interpretation. The first part of this Section does not intend to provide a detailed overview of the methods for measuring mobility. Instead, it describes the measurements chosen to be adopted in this study. For an extended explanation of the methods of measurement currently available, please refer to Jäntti and Jenkins (2013), Fields and Ok (1996), Chetty et al. (2014) and Checchi and Dardanoni (2002). For detailed papers on the qualitative comparison among estimators see Dahl and DeLeire (2008) and Stuhler and Nybom (2017).

**Intergenerational elasticity** The intergenerational elasticity (IGE) is by far the most popular mobility measure even if it has severe drawbacks especially in terms of interpretation, as explained by Jäntti and Jenkins (2013). The IGE is computed as the coefficient of a linear regression between the log of the outcome of the child on the log of the outcome of the parent, as in equation (1):

$$\log(Y) = \alpha + \beta \log(X) + \varepsilon. \tag{1}$$

Equation (1) is known as the intergenerational mobility equation, where $Y$ is the child's outcome, $X$ is the parent's outcome and $\beta$ represents the parameter of interest which is the IGE. In principle, $\beta$ can take any value but most studies find a value between 0 and 1. In order to interpret the phenomenon in a correct way, economists usually refer to individual status as the outcome variable, then consider the income or earnings as the best proxy for status. Hence a positive value of $\beta$ indicates generational persistence of permanent earnings in which higher long-run parental status favours the economic success of the offspring; a negative value indicates generational reversal of economic status. A value of 0 for the $\beta$ (economic success of adult children and parents are unrelated) corresponds to complete intergenerational mobility, whereas a value of unity (the economic success of children

is completely determined by the parental achievement) is associated with complete immobility. (1 - $\beta$) is a measure of the degree to which economic status regresses to the mean. If that equation takes the value of 1 (that is to say, $\beta = 0$), a child of parents who attain a below average long-run status can expect an average status just like the offspring of high-status parents. Therefore (1 - $\beta$) is considered as the measure of intergenerational mobility. There are two main sources of bias related to the estimation of the IGE, the attenuation bias and the life-cycle bias. The rest of the paragraph is dedicated to a short description of the typical errors arising in the context of intergenerational mobility.

The issue of the attenuation bias originates from the fact that the permanent or lifetime income is unobserved. The attenuation bias has been addressed in the past by the seminal works of Solon (1992) and Zimmermann (1992). The two authors suggest to employ multi-year averages of income in order to correct for this type of bias[2].

The life-cycle bias derives from the evidence that the time when income is observed has an effect on the estimate of intergenerational mobility. Haider and Solon (2006) point out that, based on US data, annual earnings are only suited as a proxy for lifetime earnings if these earnings are observed for individuals between their mid-thirties and mid-forties.

**Intergenerational correlation** Closely related to the intergenerational elasticity is the intergenerational correlation (IGC) that is the Pearson correlation, $\rho$, between the log of earnings at two time points. The relationship between the IGE and the IGC is expressed by the following equation:

$$\rho = \beta \frac{\sigma_1}{\sigma_2}$$

where $\sigma_1$ and $\sigma_2$ are the standard deviations of log incomes in the two periods, 1 and 2. Hence $\rho$ is equal to $\beta$ if the two marginal distributions have the same

[2]The suggestion by Solon and Zimmermann was to average on 3 to 5 years of income or earnings, later Mazumder (2005) provide tests that a 'real' proxy for permanent income would be something around ten years of income observations. The effect has been to pass from an estimate of 0.2 for United States intergenerational elasticity, to 0.4 in the Solon and Zimmermann works and 0.5 and over in Mazumder paper.

level of inequality. Regarding the interpretation of the coefficient, $H = 1 - \rho$ is the Hart (1976) index of mobility. H ranges between $-1$ and 1, and $H = 0$ coincides with the case of complete immobility.

**Methodology** The major contribution of this paper is the evaluation of the existence and extent of an additional source of bias, defined as latent status bias, in the measurement of intergenerational mobility. The starting point of the analysis is indeed rather different from the analysis of measurement error in the measuring variables. This analysis will concentrate on the existence on an underlying unobservable and latent status that is attached to each individual and can be captured or approximated with specific techniques. The dimensions that are considered as the most predictable for the economic status of an individual are: a resource based dimension, an occupational dimension and an educational dimension.

There are several methodologies available to the researcher who wishes to capture the latent status that is common to these three dimensions. The papers by Vosters (2015) as well as Nybom and Vosters (2014), adopt the combination technique proposed by Lubotsky and Wittenberg (2006) that allows for the combination of the father's dimensions of status. Other techniques such as the factor analysis and structural equation models allow for the separate combination of the dimensions and therefore can be used to obtain two separate and continuous indicators of the latent status. These techniques require different assumptions and a certain degree of correlation between the observed variables.

This paper's adopted methodology is the factor analysis model. Factor analysis is an old statistical technique introduced at the beginning of last century by Spearman and Pearson. It has the primary aim of discovering common unobservable factors underlying observable variables. The extraction of the factors is designed to take out as much common variance as possible from the first factor. After the extraction of the factors, in order to maximize validity, factor scores are produced that are highly correlated with a given factor, and unbiased estimators of the true factor scores are obtained. For a textbook explanation of the factor analysis see Bollen (1989), Harman (1976)

and Rencher (2002).

The following are the core methodological passages for the sake of the research question. As already stated there are three observed variables that are supposed to encompass comprehensive information on the status of an individual. Therefore the factor analysis model has the following structure:

$$\begin{aligned} x_1 &= \alpha_1 + \lambda_{01} x_S + \varepsilon_1 \\ x_2 &= \alpha_2 + \lambda_{02} x_S + \varepsilon_2 \\ x_3 &= \alpha_3 + \lambda_{03} x_S + \varepsilon_3. \end{aligned} \tag{2}$$

In this case we have one factor, $x_S$, that is unobservable, and three observed variables, $x_1$, $x_2$ and $x_3$. The parameters $\lambda_1$, $\lambda_2$ and $\lambda_3$ are the loadings. In line with the previous notation, the $x_i$ variables represent the father's observed variables, whilst the $y_i$ variables represent the adult child's observed variables. For the adult child the model is analogue:

$$\begin{aligned} y_1 &= \delta_1 + \lambda_{11} y_S + \eta_1 \\ y_2 &= \delta_2 + \lambda_{12} y_S + \eta_2 \\ y_3 &= \delta_3 + \lambda_{13} y_S + \eta_3. \end{aligned} \tag{3}$$

Note that the two latent status variables $x_S$ and $y_S$ are supposed to be different, and the same holds for the other parameters of the factor analysis model. In other words the factor extraction and the factor score for the adult child will be computed independently on the estimates for the father. Other models, like structural equation modeling, allows for the insertion of this kind of dependency.

The main assumption of the model is that the error terms $\varepsilon_i$ are independent of one another, such that $E(\varepsilon_i) = 0$ and $Var(\varepsilon_i) = \psi_i$. This means that all the common variance of the three observed variables is captured by the factor. The same holds true for the errors in the adult child model, $\eta_i$.

The crucial step for this methodology is that of the estimation of the loadings, that are coefficients that load on one variable that is unobserved, the individual's status. The determination of the loadings is made by the principal component method, which choose the value for the loadings that will best approximate the sample covariance matrix with the covariance matrix

of the factor analysis model.

The last step consists of the prediction of factor scores $\hat{x}_S$ and $\hat{y}_S$. The factor scores predict the location of each individual on the factor or component. These scores are continuous and standardised indicators that are adopted as proxies for the latent socio-economic status of individuals.

# 3 Data

The data adopted for studies on intergenerational mobility is usually either administrative data or survey data. The former type is preferred for their sample size and for the higher accuracy of the data on income or earnings. The second type may have a lower number of observations, but can be more powerful in terms of information about the dimensions of individual status. Therefore, this study chose to employ longitudinal household survey data. These surveys tracked members of the initial household over time, even when they decided to form new households. Hence, it was easy to construct links between the head of the original household and the adult child that became the head of another household.

**German data and previous German literature** The dataset used in this paper for Germany is the German Socio-Economic Panel (SOEP), a longitudinal survey of approximately 11,000 private households conducted in the Federal Republic of Germany from 1984 to 2015, and in eastern German länder from 1990 to 2015[3].

The leading recent papers on intergenerational mobility in Germany are those by Eisenhauer and Pfeiffer (2008) as well as Schnitzlein (2015). Less recent works are those by Grawe (2004) as well as Couch and Dunn (1997), which were included in the cross country review published by Corak (2006). Table 1 presents a synthesis of the main outcomes and methods of the papers from this literature. What is common to these studies is that they investigate the intergenerational elasticity of individual earnings as preferred mobility measurements and they adopt the SOEP survey data.

The older papers, by Couch and Dunn (1997) as well as Grawe (2004), suffer from the short length of the panel. Indeed their estimates are highly downward biased, in line with what is expected from the effect of the life-cycle

[3]SOEP data are integrated into the Cross National Equivalent File (CNEF) that contains panel data from Australia, Canada, Germany, United Kingdom (BHPS) and the United States.

bias[4].

The most recent papers are more reliable in terms of life-cycle bias. The work by Eisenhauer and Pfeiffer (2008) applied an elaborated sampling procedure that caused a severe reduction in the sample size. However, this allowed the authors to deal with the life-cycle bias that reduced at maximum the age distance between observed fathers and observed sons. Moreover the authors dealt with the classical attenuation bias by averaging the fathers income over 5 years; the result was a significant increase in the value of the IGE of earnings. The authors also put forward an instrumental variable (IV) estimation, since their argument was that the standard least squares (LS) is the lower bound of the elasticity and the IV is the upper bound. Their conclusion was that the IGE of earnings in Germany was around one third.

Schnitzlein (2015) builds on the preceding findings providing as well an international comparison with the US (PSID). The sample selection rule is restricted to a sample of fathers with more than five annual earnings observations over the ten years period under consideration (1984-1993). Schnitzlein averaged over multiple years for both the fathers and the sons in order to reduce the attenuation bias. Furthermore, as recommended by Haider and Solon (2006) to deal with life-cycle bias, the selected sons were between 35 and 42 years in the year that their earnings were observed. The estimate of IGE was equal to 0.318. The slightly higher German IGE estimate compared to Eisenhauer and Pfeiffer (2008), is likely to be due to the more mature sample of adult sons.

**British data and previous British literature** For the United Kingdom I employ the British Household Panel Survey (BHPS) from 1991-2008 which consists of around 5,500 households covering more than 10,000 individuals each year. After 18 waves, the BHPS was superseded in 2009 by a new household panel survey called Understanding Society (or UKHLS, which stands for United Kingdom Household Longitudinal Survey), which has a sample of about 30,000 households and over 54,000 individuals. At the time of writing,

[4]For a discussion on the role of life-cycle variations on the lifetime earnings in Germany, see Brunner (2010).

six waves of Understanding Society data are available for analysis.
In the UK, the literature on intergenerational mobility follows a less straightforward development, mainly due to the availability of different data sources and the adoption of different methodologies.
The main studies on intergenerational mobility on UK are based on the cohort data from 1958 and 1970, namely the National Child Development Study (NCDS) and the British Cohort Study (BCS). Both surveys are different from BHPS by construction, since they follow one cohort of individuals over time[5]. Table 2 presents a synthesis of the main outcomes and methods of the papers from this literature and distinguishes by the dataset adopted.
In terms of methodologies, the paper by Dearden et al. (1997) includes both the standard least squares approach and an alternative approach that consists in undertaking a two stages process where current income is regressed on parental characteristics, such as education and occupation, which are predictors of longer-term income variation across families. The authors use the 1958 birth cohort with sons' earnings measured at age 33 to suggest that attenuation bias is substantial enough to move the estimated IGE from 0.24 to the region of 0.55 although the authors argue that there is good reason to believe this to be an upper bound[6].
The most recent paper using NCDS and BCS is by Paul Gregg, Lindsey Macmillan and Claudia Vittori (2016). It provides an estimate of the IGE of 0.43 and also performs an estimate of rank-rank mobility.
The paper by Ermisch and Francesconi (2004) is the first to adopt BHPS to estimate the IGE (0.247), although the authors considers the Hope-Goldthorpe occupational prestige score instead of earnings. Nicoletti and Ermisch (2007) employ two sample-two stages least squares (TS2SLS) to estimate the IGE on a restricted sample of sons born between 1962 and 1972, aged between 31 and 45, who have co-resided with their fathers for at least one wave of the BHPS. The resulting estimate is equal to 0.365.

[5]For a discussion of what are the advantages of using BHPS rather than the cohort studies see Ermisch and Francesconi (2004) at page 4-5.

[6]This approach has similarities with the two sample two stages technique, when family income or fathers' earnings are unobserved but characteristics such as parental education and occupation are observed.

Since methodologies, datasets and years differ this much, it is not easy to define a benchmark level of intergenerational mobility for the UK. In order to select a preferred estimate for accuracy, methodology and recentness this study will refer to the results obtained by Gregg, Macmillan and Vittori (2016), even if the degree of comparability between my data and theirs is low.

**Dimensional indicators** As explained above three dimensions will comprise the latent status measure: the resources detained, the occupation performed and the level of education attained. One indicator will be selected for each of these three dimensions.
For the resource dimension, I selected the individual labour earnings. This is in line with the previous literature on intergenerational mobility in Germany and the United Kingdom that adopt earnings as the preferred outcome measure[7]. For the occupational dimension, I selected the Treiman's Standard International Occupational Prestige Scale (SIOPS), a scale based on prestige score rankings averaged internationally[8]. See Appendix 1 for a detailed discussion of this choice. Finally the years of education attained was selected to be the indicator for education.

**Sample selection and descriptive statistics** The selection of the sample in the context of longitudinal studies is severely constrained by the data availability. The major determinant of the selection is that children born in the first generation, which is the generation when the relevant variables for the parents were computed, are still included in the study. These children were therefore interviewed one generation later, that is around twenty years after. The issue with the selection is that not all of the former children remained in the survey until the year chosen to be the start of the second generation. In the case of Germany, the children were selected over a large time period, which is to say from 1984 to 1989. Then, the children from that

[7] The estimates based on household disposable income are included as a robustness check, see Appendix 3.

[8] See Treiman (1977) and Ganzeboom, De Graaf, and Treiman (1992).

group were observed as adults in 2010, and the links with their parents were created, in order to obtain the pairs that constituted the core of this study. The pairs of intergenerationally linked individuals are subsequently observed for a period of eight years from 1984 until 1991 for parents and from 2008 until 2015 for adult children.

The sampling procedure took into account multiple aspects that were crucial for the sake of best measuring the intergenerational mobility. In particular, I refer to the occupational position of the individuals, the earnings observations, the age and the gender. I tried as much as possible to be in line with the previous research on the topic, adopting analogous methodologies and selection rules.

The first selection rule was based on gender. Almost all the research on intergenerational mobility relies on the fathers-sons pairs, with only a few exceptions that concentrate on fathers and daughters[9]. The most common justification to this choice is reduced female participation in the labour market. However, this kind of argument is becoming less meaningful, since the data on labour market participation indicates that female participation has been increasing in the last few decades. Nonetheless, this study focused on father-sons pairs, in order to guarantee the comparability with the previous estimates. However, Appendix 2 contains additional evidence for the fathers-daughters pairs.

For the case of Germany, I started from the occupational position. The sample was restricted to those that were employed[10]for at least 2 out of the 8 years of observation of the individuals. Similarly excluded were those who had less than two earnings observations out of the eight years time span. The age restriction consisted of the exclusion of individuals who were less than 25 years old.

The result of the application of the selection rules was that the number of pairs in the sample was reduced to 304. The fathers totalled 261, which implied that there were 43 fathers connected with multiple sons. This choice

[9]See Chadwick and Solon (2002).

[10]The unemployed, retired, in education or in other conditions orthogonal to the employment status were excluded

can have consequences in terms of sample homogeneity, and Appendix 4 contains a discussion on this potential issue.

The descriptive statistics of the resulting sample are illustrated in Table 2. The main variable of interest is the level of individual earnings, measured as an 8-year average for fathers and a 3-year average for sons. The occupation variable does not represent the occupation that was performed in the reference years of 1984 and 2010; instead it represents the higher prestige value reached during the 8-year time span[11]. As in the previous literature and as is typical of the intergenerational mobility studies, the age of the adult sons is on average lower than the age of fathers. This is mostly due to the length of the survey, combined with the sample selection and the attrition. The reduction of the household size and the reduction of the number of married individuals across the two generations are compatible with the development of the society and the family over time, especially during the last decades. Finally, the number of years of observed earnings was again higher for fathers, close to the maximum available of eight. The adult sons were also observed for more than six years on average, which is enough to attenuate the measurement error.

In the case of the UK the data availability was lower since the starting year of the longitudinal study, the BHPS, was 1991, which is seven years later than the starting year of the SOEP. This case considered the children included in the 1991-1993 waves of BHPS and that are still included in the sample between 2014 and 2016; these children were linked with their respective parents. The selection procedure is similar to the one adopted in the German case; it starts from the labour status of the individuals, who have to be employed at least one year over three. Then, those that are less than 25 years old are excluded. The resulting sample was composed of 235 couples of fathers and sons. The fathers totalled 206.

The descriptive statistics of the sample are illustrated in Table 3. The earnings are registered as monthly individual labour earnings, which is typical

[11] This was made in order to correct, especially on the sons side, for the arise of any source of life-cycle bias in the occupation choice. However the outcome is analogous if the occupation performed in the reference years is considered.

of British surveys and longitudinal studies. The age gap between the two cohorts widened, as the starting year of the longitudinal study was after the one for Germany; this also caused the average of earnings to be higher for fathers than for sons.
The indicator for education consisted in the years of education attained. However in this case, those years were imputed values. The usual question regarding education within BHPS and UKHLS foresaw different categories as alternatives that were transformed into years of education. This transformation was in order to increase the comparability with the other country and the coherence of the measurement method[12].

**Comparability of Germany and the United Kingdom** Because of the peculiarities in the two datasets the correction for biases was considerably different. When using SOEP, the length of the longitudinal study allowed for a strong correction for the measurement error in the father's permanent income, translated into the use of eight years of observations (1984-1991). When using BHPS-UKHLS the correction consisted in the observation of three years of earnings for the fathers (1991-1993). The correction for the measurement error for the adult sons was made by averaging three years of earnings in the case of German data (the last three years in which the earnings were observed was between 2008 and 2015). There was no correction in the case of the British data since, for the sake of data saving, it had been chosen to only consider the amount of earnings observed in 2015. It was preferred to correct for the life-cycle bias by selecting those individuals who had earnings' observations at an older age.

[12]The transformation was based on the following relationship between years and categories: degree = 16 years or 18 years in case of a second degree, higher degree than high school = 15 years, A-level = 13 years, GCSE = 11 years, other qualification = 10 years, no qualification = 9 years. Even if the transformation could induce measurement error in the education level of individuals, it allowed to comment on the cardinality of the education indicator.

# 4 Results

The key idea of this paper is to compare the estimates for the intergenerational mobility of the single resource-based dimension, with the estimates for the intergenerational mobility of the multiple dimensions status. Hence the estimates are replicated depending on the adopted variable. However, before discussing the comparison between the two different methods, I discuss the results based only on earnings in order to verify the comparability with respect to the previous literature and the benchmark results. In the last two paragraphs of this Section, I discuss the international comparison between German and British results as well as the robustness checks.

**Intergenerational mobility of earnings** I present estimates from two regressions for the intergenerational mobility of earnings. Regression (4a) is the empirical counterpart of the intergenerational equation (1), when $y$ and $x$ are the earnings of the adult son and father respectively. Regression (4b) presents the additional explanatory variable, $Z$, which represents a set of controls such as the age of fathers and adult sons, age squared, and the household size of fathers and adult sons.

$$\log(y) = \beta \log(x) + e \tag{4a}$$

$$\log(y) = \beta \log(x) + \delta Z + e. \tag{4b}$$

The estimates are presented in Table 5 for both Germany and the United Kingdom. The intergenerational elasticity of earnings in Germany is equal to 0.322; that figure becomes 0.295 when controls are added to the basic model. The key driver of the reduction in the elasticity is the age of the sons, which is one of the few significant controls, due to the relevance of the life-cycle bias for the estimates of the intergenerational mobility. These estimates are in line with the most recent estimates from Eisenhauer and Pfeiffer (2008) as well as Schnitzlein (2015). Within the literature, a $\beta$ equal to or lower than 0.3 is considered to be indicative of a high mobility country. Moreover, in all the comparative studies such as the one by Corak (2006), the values

of $\beta$ for Germany are among the lowest in the industrialised countries.
The IGE of earnings in the United Kingdom is equal to 0.209, that becomes 0.223 when controls are added to the basic model. It is interesting to underline that the mobility in the UK seems to be lower than that in Germany; this is something rather new in the literature. However, in another paragraph of this Section, I will analyse the comparability of the results in terms of international rankings and demonstrate how they are strongly influenced by the method and the measurement errors.
When a correction is applied to average the adult sons' earnings over three years (2014-2016) instead of the single year of 2015, there is a reduction of the elasticity to 0.165. This result is coherent with the fact that the direction of the error induced by the measurement error in the adult sons' permanent income, $y$ of Equation (1), as well as the life-cycle bias are not pre-determined differently from what happens with the measurement error for the fathers' permanent income, $x$.

**Intergenerational mobility of status** The first set of findings that is presented relates to the factor analysis estimation. They are illustrated in Table 6 and 7 for both models (2) and (3) and for both countries. These results are presented in order to prove the reliability of the factor analysis model for explaining the latent variable for status of the individual. The value of the eigenvalue of the first factor is greater than one in both the models and countries, whilst the other eigenvalues (not presented) are around zero. This means that there is indeed one single factor that loads on the three observed variables. The level of the loadings is always higher than 0.5, which is the threshold to consider whether one variable is explicative for one factor.
The scores that were obtained from the factor analysis explained in Section 2 were standardised with a mean equal to zero and a standard deviation equal to one[13]. This implies that the computation of the regression coefficient is the same as the computation of the Pearson correlation coefficient between

[13]Figure 1 and Figure 2 illustrate the distribution of the status' scores and of the values of standardized earnings.

the variables. That is why this study adopted the correlation coefficient in order to compare the estimates of the status mobility and of the unidimensional earnings mobility. As explained in Section 2 the interpretation of the regression coefficient ($\beta$) and of the correlation coefficient ($\rho$) is exactly the same in terms of mobility: the higher is the coefficient, the lower the mobility in the two distributions.

The estimates are presented in Table 8. The intergenerational mobility of the status, in terms of $\rho$ is equal for Germany to 0.465 and for the United Kingdom to 0.435. These two coefficients are remarkably higher than the ones obtained from earnings that were equal to 0.278 for Germany and 0.184 for the UK. Given that the level of mobility is the complement of the estimate of the coefficient, the increase in the $\rho$ corresponds to a decrease in the mobility of around thirty percent for both Germany and the United Kingdom.

This increase seems positively answer to the research question regarding the existence of the latent status bias: there is indeed some correlation among the status variables that increases the probability of being poor or rich over multiple generations. This results in the increase of status persistence across generations with respect to the single earnings persistence.

**International comparison** As anticipated in Section 3, the correction for the errors when using earnings as an indicator for resources, was different across the German and British data. This implies that the results are not directly comparable in terms of magnitude. In particular, I refer to the results of the unidimensional mobility measurement, because the literature about international comparisons has always located Germany below the UK in terms of intergenerational elasticity and therefore above in terms of mobility[14]. According to the estimates of Table 5 and Table 8 that refer respectively to the regression coefficient and the correlation coefficient, the international ordering would be reversed.

In order to facilitate the comparability between the two countries analysed, I adapted the German data to the British data. In other words, I selected

[14] See Corak(2006) and Blanden(2009).

another sample from SOEP, with a correction for measurement error and life-cycle bias that is in line with the one available for UK. To analogise to the British dataset, this sample was comprised of fathers whose earnings were observed for three years, between 1984 and 1986, and adult sons, whose earnings were observed in a single year. Since there was no reason to select a specific year, I present results of the estimated levels of mobility when the earnings were observed in 2010, 2011, 2012, 2013, 2014 and 2015. The sample size reduced over this time period and the average age increased.

The main findings are available in Figure 3 and Figure 4. Figure 3 compares the intergenerational elasticity ($\beta$) in Germany and the United Kingdom. The dots represent the elasticity when the adult sons' earnings are computed using only one year of observation, and the fathers' earnings are computed with 3 years of observation. The red line represents the elasticity for Germany computed with the optimal correction for the errors (8 years of average for fathers and 3 years for adult sons). The black line represents the elasticity for the United Kingdom. For 3 years out of 6, the new estimates for Germany were in line with that for the UK, for the remaining 3 years the elasticity in Germany was significantly lower than that in the UK. Hence it is possible to affirm that the international ordering in terms of elasticity is confirmed when examining comparable estimates.

Figure 4 presents what happens in terms of correlation; the dots represent new values of correlation. The results were analogous to the ones for elasticity, except that the two countries appeared to have a similar level of mobility in terms of correlation. Moreover, the graph uses red dots to illustrate the status' correlations in single years in order to confirm that the role of the latent status bias is still significant even with this less precise data structure. Hence, it can be concluded that the use of other dimensions that are different but combined with earnings can help to correct for the biases that arise from the earnings measurement.

Table 10 presents the preferred estimates for the international comparisons, which are those with the adult sons earnings in 2010. These estimates are preferred because the sample size is maximized; it is equal to 310 pairs. The findings indicate that the mobility in Germany is higher than in the United

Kingdom. The gap reduces when the correlation is employed instead of the elasticity of earnings and reduces further in relative terms when the status indicator is computed.

**Robustness Checks** This paragraph presents the results of the performance of the robustness checks. The ones included here are those mostly related to the research topic, which is the use of multiple dimensions as proxies for status when measuring intergenerational mobility. These include in particular the adoption of the Lubotsky Wittenberg (LW) method instead of the factor analysis, and the computation of the correlation of the International Socio-economic Index (ISEI) levels. Other robustness checks include the computation of fathers-daughters intergenerational mobility, and the intergenerational elasticity of household disposable income as addressed in Appendix 2 and Appendix 3.

The method proposed by Lubotsky and Wittenberg (2006) has the peculiarity of reducing the relevance of the bias when dealing with multiple proxies of a latent variable. In this case the proxies are earnings, occupation and education and the latent variable is the status of the individual. This technique has been adopted by Vosters (2014) as well as Vosters and Nybom (2015) to illustrate how the addition of other dimensions to the status of individuals does not influence the results in terms of intergenerational mobility. However, this addition allows for the combination of the proxies for the fathers but not for the sons. That is why the choice was to adopt another technique. Nonetheless the results in terms of LW are presented in Table 9. For Germany there was an increase in the coefficient, that grew from the initial value of 0.322 to 0.373. For the United Kingdom the $\beta$ increased from 0.209 to 0.249. On the contrary to the preceding works that adopted LW, there was indeed an increase in the estimate and hence a reduction in mobility. However, in terms of magnitude, this increase and reduction was less significant than what happened to the correlation coefficient once at the status indicator that came out from the factor analysis was examined. The aforementioned explanation for this is that the LW method does not allow for taking into account the correlation between the fathers' earnings, occu-

pation and education, whereas it is possible to evaluate the effect of this extra correlation when the factor analysis is employed .

Table 9 presents the results of the estimates computed using the ISEI. The $\beta$ coefficient for Germany was equal to 0.377, which is in line with the value computed using the LW method.

# 5 Conclusions

This paper confirms that the level of mobility within a society is probably lower than what had been believed by the economic literature of intergenerational mobility. This itself is not a new conclusion; what is new is the reason for that underestimation. The phenomenon of the persistence of inequality or equivalent of the intergenerational mobility is influenced by various forms of friction that operates within the transmission of the economic status across generations. These multiple frictions logically induce an increase in the persistence if they are taken into account all at the same time. This is the interpretation given to the increase in magnitude of the estimate of intergenerational correlation when examining the multiple dimensions status with respect to the unidimensional case based on earnings.

These empirical results are indeed relevant for the measurement literature of intergenerational mobility. What matters in terms of mobility is not only the single indicator of earnings or income but also the indicators of the other dimensions an individual's status. Even if there is yet to be a consensus over mobility measurement, this paper suggests that it would be preferable to work on a multidimensional index, given the existence and extent of this additional amount of mobility that derives from the combination of dimensions.

With regard to economic interpretations, especially in relation to inequality, it could be interesting to interpret the empirical results within the theory of intergenerational mobility. There are papers whose authors modify the typical Becker-Tomes-Solon framework in order to include for instance variation in the quality of the schooling (as in Andreu and Hindriks [2017]), forms of segregation or stratification based on neighbourhoods (as in Durlauf[1996] and Benabou [1996]) or a dual labour market (as in the seminal paper by Galor and Zeira [1993]). An attempt to insert multiple sources of frictions in the market for studying the effects on intergenerational theoretical models could be a relevant sequel to this paper.

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Table 1: **Previous German estimates**

| Authors | Estimation Method | Coefficient |
|---|---|---|
| Couch and Dunn (1997) | LS | 0.11 |
| Grawe (2004) | LS | 0.095 |
| Grawe (2004) | generated | 0.320 |
| Eisenhauer and Pfeiffer (2008) | LS | 0.282 |
| Eisenhauer and Pfeiffer (2008) | IV[1] | 0.374 |
| Schnitzlein (2015) | LS | 0.318 |

[1] The instrument adopted is father education

Table 2: **Previous British estimates**

| Authors | Data source | Estimation Method | Coefficient |
|---|---|---|---|
| Dearden et al. (1997) | NCDS - BCS | LS | 0.240 |
| Dearden et al. (1997) | NCDS - BCS | IV[1] | 0.581 |
| Gregg, Macmillan and Vittori (2016) | NCDS - BCS | LS | 0.430 |
| Ermisch and Francesconi (2002) | BHPS | LS[2] | 0.208 |
| Nicoletti and Ermisch (2007) | BHPS | TS2SLS | 0.365 |

[1] The instrument adopted is father's education dummies
[2] The status is measured in terms of Hope-Goldthorpe scores of occupational prestige.

Table 3: **Descriptive statistics (averages) - Germany**

| **Variables** | Fathers | Adult Sons |
|---|---|---|
| Earnings | 37,713 [a] | 39,539 [b] |
| Age | 38.7 | 37.5 |
| HH size | 4.1 | 3.0 |
| Yrs education | 11.0 | 12.6 |
| Occupation[c] | 45.0 | 49.6 |
| Married | 0.95 | 0.54 |
| Yrs observed earnings[d] | 6.8 | 7.9 |

[a] 8-year averages of adjusted individual labour earnings expressed in euros
[b] 3-year averages of adjusted individual labour earnings expressed in euros
[c] Occupation expressed in terms of the Treiman prestige scores
[d] Over a maximum of 8 years
Number of observations = 304
Source: SOEPv32 (1984–2015)

Table 4: **Descriptive statistics (averages) - United Kingdom**

| **Variables** | Fathers | Adult Sons |
|---|---|---|
| Earnings | 2,264 [a] | 2,071 [b] |
| Age | 42.7 | 35.6 |
| HH size | 4.2 | 2.9 |
| Yrs education [c] | 12.2 | 13.6 |
| Occupation[d] | 45.5 | 44.6 |
| Married | 0.97 | 0.45 |
| Yrs observed earnings[e] | 2.9 | 2.9 |

[a] 3-year averages of monthly adjusted individual labour earnings expressed in pounds
[b] 2015 monthly adjusted individual labour earnings expressed in pounds
[c] Imputed
[d] Occupation expressed in terms of the Treiman prestige scores
[e] Over a maximum of 3 years
Number of observations = 235
Source: BHPS-UKHLS

Table 5: **Regression estimates ($\beta$)**

| | **Germany**[1] | | **United Kingdom**[2] | |
|---|---|---|---|---|
| | (4a) | (4b) | (4a) | (4b) |
| **Explan. var.** | | | | |
| $\boldsymbol{\beta}$ coefficient | 0.322*** | 0.295*** | 0.209*** | 0.223*** |
| s.e | 0.086 | 0.081 | 0.059 | 0.051 |
| **Controls** | | | | |
| fathers age | - | −0.040 | - | 0.023 |
| s.e | | 0.047 | | 0.044 |
| fathers age2 | - | 0.000 | - | 0.000 |
| s.e | | 0.000 | | 0.001 |
| sons age | - | 0.262*** | - | 0.047 |
| s.e | | 0.073 | | 0.052 |
| sons age2 | - | −0.003*** | - | 0.000 |
| s.e | | 0.001 | | 0.000 |
| fathers HH size | - | 0.009 | - | 0.026 |
| s.e | | 0.031 | | 0.041 |
| sons HH size | - | 0.051* | - | 0.012 |
| s.e | | 0.029 | | 0.032 |
| $R^2$ | 0.045 | 0.236 | 0.217 | 0.248 |

[1] 8-year averages of logarithmized adjusted individual labour earnings for fathers, 3-year averages of logarithmized adjusted individual labour earnings for adult sons

[2] 3-year averages of logarithmized monthly adjusted individual labour earnings for fathers, 2015 logarithmized monthly adjusted individual labour earnings for adult sons

Level of significance: *** 1%, ** 5%, * 10 %

Number of observations = 304 for Germany, 235 in UK.

Source: own calculations based on SOEPv32 (1984–2015) and BHPS-UKHLS

Table 6: **Factor analysis model estimation: Germany**

| Model | **Variable** | **Loadings, $\lambda_i$** | **Uniqueness** |
|---|---|---|---|
| (2) | Earnings, $\boldsymbol{x_1}$ | 0.794 | 0.370 |
| | Occupation, $\boldsymbol{x_2}$ | 0.885 | 0.216 |
| | Education, $\boldsymbol{x_3}$ | 0.863 | 0.256 |
| | Eigenvalue of the first factor | | 2.157 |
| (3) | Earnings, $\boldsymbol{y_1}$ | 0.672 | 0.548 |
| | Occupation, $\boldsymbol{y_2}$ | 0.828 | 0.314 |
| | Education, $\boldsymbol{y_3}$ | 0.856 | 0.266 |
| | Eigenvalue of the first factor | | 1.871 |

Source: SOEPv32

Table 7: **Factor analysis model estimation: UK**

| Model | **Variable** | **Loadings, $\lambda_i$** | **Uniqueness** |
|---|---|---|---|
| (2) | Earnings, $\boldsymbol{x_1}$ | 0.721 | 0.480 |
| | Occupation, $\boldsymbol{x_2}$ | 0.829 | 0.313 |
| | Education, $\boldsymbol{x_3}$ | 0.801 | 0.359 |
| | Eigenvalue of the first factor | | 1.848 |
| (3) | Earnings, $\boldsymbol{y_1}$ | 0.688 | 0.527 |
| | Occupation, $\boldsymbol{y_2}$ | 0.833 | 0.306 |
| | Education, $\boldsymbol{y_3}$ | 0.787 | 0.381 |
| | Eigenvalue of the first factor | | 1.786 |

Source: BHPS - UKHLS

Table 8: **Correlation Estimates ($\rho$) with earnings and with status**

| | **Indicator** | |
|---|---|---|
| **Country** | Earnings | Status |
| Germany | 0.278 | 0.465 |
| United Kingdom | 0.184 | 0.435 |

Source: SOEPv32, BHPS-UKHLS

Table 9: **Robustness checks: other methods**

| | **Coefficient** | | |
|---|---|---|---|
| **Country** | $\beta_{LS}$ | $\beta_{LW}$ | $\beta_{ISEI}$ |
| Germany | 0.322 | 0.373 | 0.377 |
| United Kingdom | 0.209 | 0.249 | |

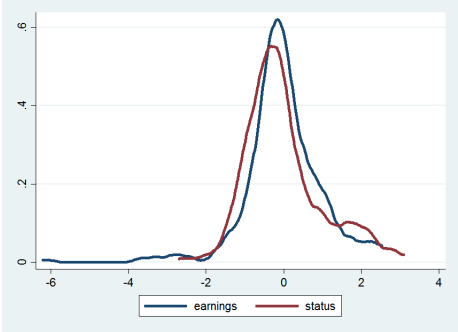
Source: SOEPv32, BHPS-UKHLS

Table 10: **International comparison**

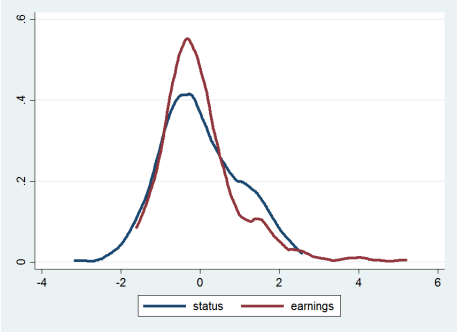
| | **Coefficient** | | |
|---|---|---|---|
| **Country** | $\beta$ | $\rho$ | $\rho_{status}$ |
| Germany | 0.099 | 0.152 | 0.398 |
| United Kingdom | 0.209 | 0.184 | 0.435 |

Source: SOEPv32, BHPS-UKHLS

Fig. 1: Distribution of earnings and status - Germany



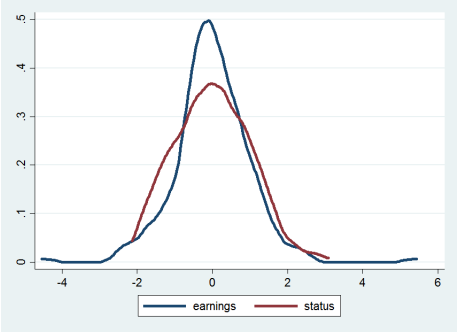

(a) fathers




(b) adult sons

Fig. 2: Distribution of earnings and status - United Kingdom

(a) fathers




(b) adult sons

Fig. 3: International comparison of intergenerational elasticity ($\beta$)

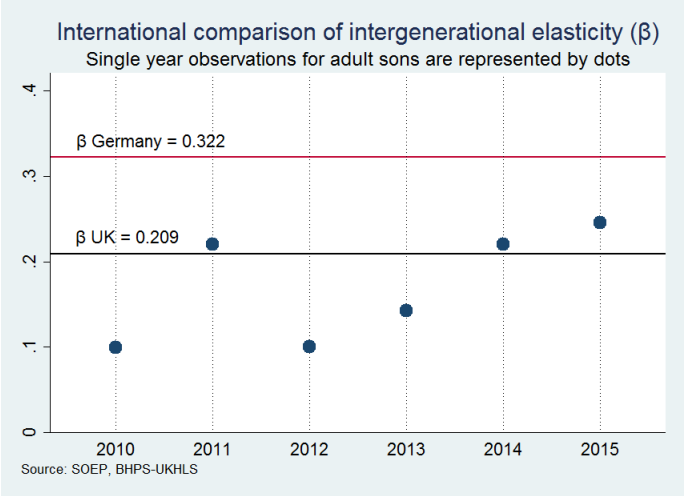
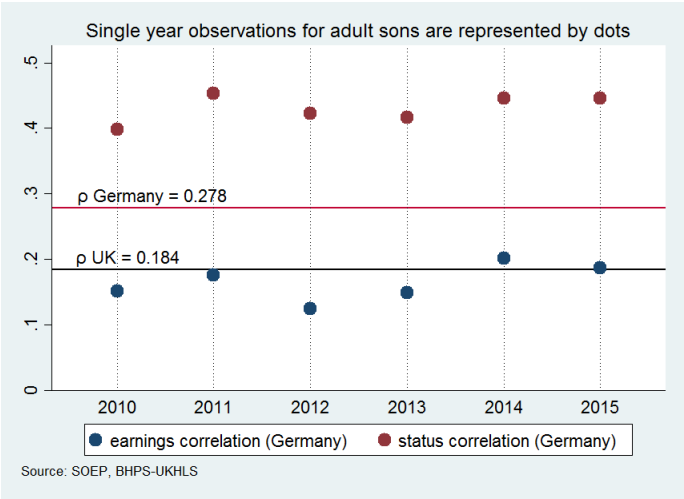



Fig. 4: International comparison of intergenerational correlation ($\rho$)



## Appendix 1 - Choice of the occupation indicator

While measuring income is relatively straightforward, to decide on the best way to measure occupational status it is challenging. Although there is general agreement in the literature that occupations should be ranked in some way, there are differing views on the appropriate scale that ought to be adopted.

First of all it is necessary to clarify the meaning of the term occupation. As argued by Hauser and Warren (1997) a job is a specific and sometimes unique bundle of activities carried out by a person in the expectation of economic remuneration. An occupation is an abstract category used to group and classify similar jobs.

The main form of categorization is definitely the International Standard Classification of Occupations (ISCO), that is done by ILO (International Labour Organization). This categorization is updated once every twenty years, the last time was in 2008, the preceding were in 1988 and 1968. Most of the surveys categorize the occupations according to this standard, especially ISCO-88. It is available at different levels of precision, at two, three or four digits.

The topic of constructing a proper categorization of occupations, known as well as social stratification, has been the core of a specific stream of sociology called economic sociology. Within this stream there are two approaches, the class approach and the hierarchical approach also known as categorical and continuous approach. Class schemas and categorical classifications belong to the class approach: examples are the EGP (Erikson-Goldthorpe-Portocarero) scheme, the Wright class scheme[15] and the Hollingshead Four-Factor Index of Socioeconomic Status[16]. Another example is that of the European Socio-economic Classification (ESEC)[17].

Within the hierarchical approach there are two major categories that distinguish among the occupational rankings. The first includes those indexes or scores that employ the median income or education (or both) of work-

[15] See Wright(1985).

[16] See Hollingshead (1975).

[17] See Rose and Harrison(2007).

ers in a given occupation to determine a score. Such measures include: the Duncan Socioeconomic Index[18], the Occupational Income Score, the Hauser-Warren Socioeconomic Index, Nam-Powers-Boyd Occupational Status Score. The second category of measures employs survey data from respondents on the perceptions of occupations to construct rankings of occupational prestige. These include the Nakao-Treas Occupational Prestige Score[19] and the Treiman's Standard International Occupational Prestige Scale (SIOPS) . The two categories reflect different conceptual approaches to measuring status. The second one, that constructs an occupational prestige ranking, has been considered suitable for the sake of this paper, whose spirit is that of combining different dimensions of the status, hence this categorization, less correlated to the resources or the education than the others, seems more appropriate. Among the prestige scores I decided to use the Treiman's SIOPS Occupational Prestige Score because it has been adopted mostly on European data, whereas the Nakao-Treas ranking is more employed with US data[20].

Two categorization or indexes, which are particularly relevant for this paper, deserve a peculiar attention. The first is the International Socio-Economic Index (ISEI) developed by Ganzeboom, De Graaf, and Treiman (1992), that is just the Duncan's SEI extended internationally to the developed countries. The ISEI is simply a weighted average of occupational education and income. Once the weights have been determined, prestige plays no part in the index. Occupation is the intervening link between education and occupation. Education is considered more important than social position for individual success. The correlation of intergenerational levels of ISEI has been included as a robustness check at the end of Section 4.

The second index described more accurately is the Hope-Goldthorpe index of occupational prestige adopted by Ermisch and Francesconi (2002). The Hope-Goldthorpe scale has 36 categories ranked in order of "social desirabil-

[18]See Duncan (1961). This index was used by Zimmermmann (1992) as an instrument for the social status of fathers.

[19]See Nakao and Treas (1994).

[20]This categorization has been used in the literature for measuring occupational mobility in the paper by Mazumder and Acosta (2015).

ity" of male occupations and it is based on a survey in England and Wales where respondents had to provide information about social desirability of male occupations[21]. This index is specific for British data, however because of data unavailability I was not able to conduct a robustness check using this categorization instead of SIOPS.

[21] See Goldthorpe and Hope (1974)

## Appendix 2 - Fathers-Daughters mobility

This appendix describes what happens if the fathers-daughters pairs and not the fathers-sons pairs are examined[22]. Most of the literature on intergenerational mobility focuses on fathers-sons pairs since the women were considered not enough integrated into the labour market.
The sample selection is the same as the one adopted for sons. The resulting number of pairs was equal to 275. The descriptive statistics are presented in Table 11.

Table 11: **Descriptive statistics (averages) - Germany - Fathers-Daughters**

| **Variables** | Fathers | Adult Daughters |
|---|---|---|
| Earnings | 39,953 [a] | 22,930 [b] |
| Age | 37.7 | 36.9 |
| HH size | 4.1 | 2.9 |
| Yrs education | 11.4 | 12.9 |
| Occupation[c] | 46.0 | 49.3 |
| Married | 0.95 | 0.49 |
| Yrs observed earnings[d] | 6.6 | 7.9 |

[a] 8-year averages of adjusted individual labour earnings expressed in euros
[b] 3-year averages of adjusted individual labour earnings expressed in euros
[c] Occupation expressed in terms of the Treiman prestige scores
[d] Over a maximum of 8 years
Number of observations = 275
Source: SOEPv32 (1984–2015)

The only relevant difference with respect to Table 3, that summarizes the information of the sample composed by the fathers-sons pairs, is that

[22] This check is applied only to German data in order to avoid issues related to the restricted data availability in BHPS-UKHLS.

regarding the average of earnings of the adult daughters. As expected, the average was considerably lower than that of adult sons and as well than that of the corresponding fathers. This did not prevent to build an analysis of the intergenerational mobility across generations. The results are presented in Table 12.

Table 12: **Estimates - fathers-daughters pairs - Germany**

| | **Earnings**[1] | | | **Status**[2] |
|---|---|---|---|---|
| **Measure** | $\beta_{LS}$ | $\beta_{LS}$ | $\rho$ | $\rho$ |
| | 0.374 | 0.286 | 0.266 | 0.431 |
| controls[1] | | X | | |

[1] 8-year averages of adjusted household disposable income expressed in euros for fathers, 3-year averages of adjusted household disposable income expressed in euros for sons.

[2] Status score that is extracted from the factor analysis model.

[3] Age of father, age of father squared, age of adult daughter, age of adult daughter squared, father household size, adult daughter household size.
Number of observations = 275
Source: SOEPv32

The level of the $\beta$ computed as an elasticity was equal to 0.374, higher than the one for sons. However what is important to underline is that the regression coefficient is sensible to both changes in the position on the distribution and in the size of the distribution. In this case the reduced average earnings of the two generations can generate a form of downward mobility that is not due to changes in positional mobility but only to the fact that women in the sample earn less that men. That is why it is always important to examine also the correlation coefficient that captures only on the positional mobility, for avoid any confusion. The $\rho$ was equal to 0.266, a value significantly lower than the IGE, $\beta_{LS}$. Finally the correlation of status, always using the scores extracted from the factor analysis, was 0.431 and this confirms the direction of the bias seen for the sons.

## Appendix 3 - Household disposable income

As explained in Section 2 most of the literature on intergenerational mobility uses earnings as the indicator of resources. However there are other indicators that could be alternative to earnings, for instance the wealth or the family income. For wealth the main reference is the paper by Charles and Hurst (2003) in which the authors use the American PSID. For family income there are more references and according to Corak (2006) the studies using total family income generally find higher values for $\beta$ than those based solely on earnings. The focus on family income has different implications because it takes into account as well the role of the mother as producer of income in the family of origin and of the spouse or partner in the family of destination. In other words it induces to consider the transmission of status not at the individual level but at the family level, something that can be reasonable. Moreover, another additional point is that related to the role of the state, since the best proxy for family income is the household disposable income that includes the redistribution done by taxes.

It was verified what happens when using household disposable income instead of individual labour earnings with both SOEP and BHPS-UKHLS. It is important to underline that the sample selection procedure was different in this case, since it was necessary to take into account the fact that the adult sons have to be autonomous from the former household when their household income is observed. This caused the fact that the sample size reduced to 246 fathers-sons pairs in Germany and 196 in the United Kingdom. The estimates of intergenerational mobility are presented in Table 13 and Table 14.

Table 13: **Estimates - Household disposable income - Germany**

| | **Income**[1] | | | **Status**[2] |
|---|---|---|---|---|
| **Measure** | $\beta_{LS}$ | $\beta_{LS}$ | $\rho$ | $\rho$ |
| | 0.290 | 0.236 | 0.195 | 0.448 |
| controls[3] | | X | | |

[1] 8-year averages of adjusted household disposable income expressed in euros for fathers, 3-year averages of adjusted household disposable income expressed in euros for sons.
[2] Status score that is extracted from the factor analysis model.
[3] Age of father, age of father squared, age of adult son, age of adult son squared, father household size, adult son household size.
Number of observations = 246
Source: SOEPv32

Table 14: **Estimates - Household disposable income - United Kingdom**

| | **Income**[1] | | | **Status**[2] |
|---|---|---|---|---|
| **Measure** | $\beta_{LS}$ | $\beta_{LS}$ | $\rho$ | $\rho$ |
| | 0.201 | 0.212 | 0.198 | 0.425 |
| controls[3] | | X | | |

[1] 3-year averages of adjusted household disposable income expressed in pounds for fathers, 2015 adjusted household disposable income expressed in pounds for sons.
[2] Status score that is extracted from the factor analysis model.
[3] Age of father, age of father squared, age of adult son, age of adult son squared, father household size, adult son household size.
Number of observations = 196
Source: BHPS-UKHLS

In the German case, the elasticity, 0.290, was just slightly lower than the one computed with earnings. The intergenerational correlation, $\rho$, saw a

significant reduction with respect to the elasticity and it was equal to 0.195. In line with the results of all the rest of the paper, the status correlation was around 0.450 and demonstrates how the mobility grows when are considered at more dimensions and not only the single resource-based dimension, in this case household disposable income. The findings from the British data were coherent with the German ones.

## Appendix 4 - Sample homogeneity

The national representativity of the two datasets adopted in this paper, SOEP and BHPS-UKHLS, is well proved and accepted. However, once the sample is selected on the basis of the strict selection rules that have to be followed in the context of intergenerational mobility to link individuals across generations, the representativity of the sample at the population level is questionable. As discussed in Corak (2004), one of the advantages of using BHPS instead of the cohort data is the fact that children and parents come from more than one cohort and this can help to reduce the error arising from sample homogeneity. This issue is described and analysed by several papers such as that by Solon (1992), Dearden et al. (1997) and Eisenhauer and Pfeiffer (2008). Another source of bias related to the homogeneity of the sample is due to the attrition in the panel studies, the individuals that go out from the study tend to be of a lower class than those that tend to remain in the study for a longer period of time. The paragraph describes the findings of a comparison between the averages of the restricted sample, the one used in this paper and the full sample both for SOEP and BHPS-UKHLS. The full sample was composed, for fathers, by all the individuals that were fathers of children born between 1984 and 1989. For sons it was composed by all the adults that were registered as children between 1984 and 1989, observed in 2010. The results are presented in Table 15 for Germany and Table 16 for the United Kingdom. The results indicate that the averages of the restricted and full samples were substantially the same. The value of the restricted sample that was remarkably above the average of the full sample was that of the adult sons earnings in Germany.

Table 15: **Check for sample homogeneity - Germany**

| | **Restricted Sample** | | **Full Sample** | |
|---|---|---|---|---|
| **Variables** | Fathers | Sons | Fathers | Sons |
| Earnings | 37,713[a] | 39,539[b] | 37,118[a] | 28,657[b] |
| Age | 38.7 | 37.5 | 38.7 | 34.5 |
| HH size | 4.1 | 3.0 | 4.3 | 3.4 |
| Yrs education | 11.0 | 12.6 | 10.9 | 12.2 |
| Occupation[c] | 45.0 | 49.6 | 44.7 | 48.2 |
| Married | 0.95 | 0.54 | 0.95 | 0.57 |
| No. Observations | 304 | 304 | 1,726 | 6,545 |

[a] 8-year averages of adjusted individual labour earnings expressed in euros
[b] 3-year averages of adjusted individual labour earnings expressed in euros
[c] Occupation expressed in terms of the Treiman prestige scores
Source: SOEPv32 (1984–2015)

Table 16: **Check for sample homogeneity - United Kingdom**

| | **Restricted Sample** | | **Full Sample** | |
|---|---|---|---|---|
| **Variables** | Fathers | Sons | Fathers | Sons |
| Earnings | 2,264[a] | 2,071[b] | 2,102[a] | 2,152[b] |
| Age | 42.7 | 35.6 | 40.6 | 39.8 |
| HH size | 4.2 | 2.9 | 4.2 | 3.4 |
| Yrs education [c] | 12.2 | 13.6 | 11.8 | 13.5 |
| Occupation[d] | 45.5 | 44.6 | 44.2 | 43.6 |
| Married | 0.97 | 0.45 | 0.95 | 0.58 |
| No. Observations | 235 | 235 | 1,397 | 2,640 |

[a] 3-year averages of monthly adjusted individual labour earnings expressed in pounds

[b] 2015 monthly adjusted individual labour earnings expressed in pounds

[c] Imputed

[d] Occupation expressed in terms of the Treiman prestige scores

Source: BHPS-UKHLS