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ABSTRACT

The Chips Are Down: The Influence of Family on Children's Trust Formation*

Understanding the formation of trust at the individual level is a key issue given the impact that it has been recognized to have on economic development. Theoretical work highlights the role of the transmission of values such as trust from parents to their children. Attempts to empirically measure the strength of this transmission relied so far on the cross-sectional regression of the trust of children on the contemporaneous trust of their parents. We introduce a new identification strategy which hinges on a panel of parents and their children drawn from the German Socio-Economic Panel. Our results show that: 1) a half to two thirds of the observed variability of trust is pure noise irrelevant to the transmission process; 2) this noise strongly biases the parameter estimates of the OLS regression of children's trust on parents' trust; however an instrumental variable procedure straightforwardly emerges from the analysis; 3) the dynamics of the component of trust relevant to the transmission process shed light on the structural interpretation of the parameters of this regression; 4) the strength of the flow of trust that parents pass to their children as well as of the sibling correlations due to other factors are easily summarized by the conventional R^2 of a latent equation. In our sample, approximately one fourth of the variability of children's trust is inherited from their parents while two thirds are attributable to the residual sibling correlation.

JEL Classification: J62, P16, Z1

Keywords: trust, intergenerational transmission, siblings correlations, cultural transmission

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1 Introduction

The role of culture on economic choices and its effect on economic development is the subject of a lively debate in recent research. Among the cultural traits, trust towards others is one of the the most studied by social scientists (see Alesina and Giuliano, 2016 for a review).[1] Following the seminal contributions of Banfield (1958), Coleman (1988, 1990) and Putnam (1993, 2000), trust has been found to affect economic development (Knack and Keefer, 1997), innovation (Fukuyama, 1995), individual performance (Butler et al., 2016), financial development and trade (see Guiso et al., 2004, 2008c, 2009), and firm productivity (Bloom et al., 2012; La Porta et al., 1997). For a comprehensive review of the role of trust in economics, see Algan and Cahuc (2013).[2]

Considering the important influence of trust on economic outcomes, the process of its formation is of key interest. At a broader level, theoretical work has highlighted the role of intergenerational transmission of values – such as trust – shedding light on the persistence of ethnic differences (Bisin and Verdier, 2001).[3]. More recent studies have attempted to provide empirical content to the intergenerational transmission of values. In particular, using data from the German Socio-Economic Panel (GSOEP), Dohmen et al. (2012) analyze the transmission of trust and risk attitudes from parents to children within a regression framework whereby children's attitudes are modelled as a function of those of parents. Their results suggest the presence of a positive intergenerational correlation.[4]

We build upon existing work and exploit longitudinal data to study how trust is transmitted from parents to their children. The cruciality of longitudinal data transpires in several steps of our analysis. First, we can disentangle the role of the direct transmission of trust from parents to children from that played by other factors of the environment shared by siblings. This distinction would not be possible with cross-sectional data.

Second, we delve into the assumption that individual trust is invariant over time. This con-

[1] In this paper, we refer to "generalized" trust, which concerns our beliefs about the anonymous other. In other words, trust refers to the relations among individuals who are not bound by the kind of personal ties that bind members of the same family, or fellow workers (Algan and Cahuc, 2013).

[2] Effectively, Arrow (1972) states that "Virtually every commercial transaction has within itself an element of trust, certainly any transaction conducted over a period of time. It can be plausibly argued that much of the economic backwardness in the world can be explained by the lack of mutual confidence." Following his reasoning, the absence of markets or their malfunctioning, the misallocation of resources and, more generally, the differences in economic performance, could be ultimately attributed to the lack of trusting behavior.

[3] Related work has shown the importance of intergenerational transmission on fertility and work practises across cultures (Fernández and Fogli, 2009; Guiso et al., 2006; Fernández, 2008)

[4] An alternative strategy to identify the intergenerational transmission process is to focus on immigrants' attitudes. The central idea is to understand how immigrants' values – shaped by the diverse cultural and institutional background of their home countries – react and adapt to the environment in the common host country. For example, Ljunge (2014) estimates the intergenerational transmission of trust by analysing children of immigrants in 29 European countries with ancestry in 87 different nations. His approach entails performing regressions of the level of trust of second-generation immigrants on the average trust of the country of origin of parents. Remarkably, their results suggest that the transmission of trust is relevant only on the mother's side. Moschion and Tabasso (2014) use a similar approach with data on second generation immigrants in Australia and the United States to study how the mechanism of the transmission process varies in the two host countries.

jecture has been the crucial but somewhat controversial argument on which the existing empirical analysis hinges. It is crucial because parents' and children' trust used in regression analyses are contemporaneously measured at the time of the interviews – while ideally they should be gauged at the time the transmission took place. These two measurements are equivalent only under the invariance of trust over time. It is a controversial hypothesis too since, for instance, in their U.S. longitudinal study, Poulin and Haase (2015) find that generalized trust changes with age. We exploit a three-wave panel dataset constructed from the German Socio-Economic Panel to model the dynamics of individual trust over a decade, distinguishing between its *permanent* and *transient* component. Within this framework, we test for the invariance of the permanent component of trust finding no evidence to reject it. Remarkably, we find that the transient component accounts for a large fraction of the variance of observed trust.

Third, building on the distinction between the two components, we argue that only permanent trust matters for the transmission process. To circumvent the unobservability of permanent trust, we show that the *unfeasible* regression of the permanent trust of children on the permanent trust of their parents is equivalent to estimating the regression of the observable counterparts of permanent trust using the lagged levels of parents' trust as instruments for the corresponding current level.

Last but not least, we show how to evaluate the relative importance of the intergenerational transmission and the residual siblings correlation to the formation of children's trust. As pointed out by Solon et al. (1991) in their study on the role of family background as a determinant of the economic status of children, the distinction between transient and permanent components is crucial.

In summary, the contribution of our study is threefold. 1) From a methodological point of view, we provide a setup for the study of the evolution of individual trust over time – as well as of its intergenerational transmission – which can be adapted to other attitudes and cultural values; 2) We complement existing work on intergenerational transmission of trust by clarifying the conditions required to attach a structural interpretation to parameter estimates of a regression of the trust of children on the *contemporaneous* trust of their parents; 3) We separately identify the intergenerational correlation and the residual siblings correlation; 4) We derive both a simple estimator of the transmission parameters and an appropriate measure of the strength of the transmission process between generations.

The main results can be summarised as follows: i) in line with previous work, but with stronger effect, we find that it is the mother that has a substantial role on the transmission of permanent trust to children. On the other hand, the correlation between the permanent trust of fathers and their children is due to the *strong* correlation between the permanent trust of the two parents; ii) the strength of the intergenerational transmission is far from being substantial. We find that the parents' permanent trust accounts for approximately 20% of the variance of children's permanent trust; iii) on the other hand, the residual siblings correlation accounts for a large proportion of that variance, pointing to the existence of environmental factors shared by siblings which are independent on their parents' trust but are relevant to the formation of their own trust.

The remainder of the paper is organized as follows. Section 2 provides a brief review of the literature on cultural transmission. Section 3 outlines a framework where we introduce the distinction between permanent and transient trust and clarifies the conditions required to attach a structural interpretation of the regression parameters. Section 4 describes the data and the econometric model. Section 5 presents the results of the test for invariance of trust and of the estimates of intergenerational transmission parameters and residual siblings correlation. Section 6 follows with a discussion of our results and of their implication for the literature on long term persistence. Section 7 concludes.

2 Theoretical background

The first theoretical frameworks for the study of cultural transmission are due to Cavalli-Sforza and Feldman (1981) and Boyd and Richerson (1988), who apply models of evolutionary biology to the transmission of beliefs, preferences and norms. These works show how cultural traits can be acquired through learning and other forms of social interactions. Cultural transmission is seen as the result of the direct vertical socialization (the role played by parents), and the horizontal and oblique socializations (taking place in the society). Horizontal and oblique socializations can be described as imitation and learning behaviors, and refer mainly to the interactions with peers and the environment outside the family. Cultural transmission is different from genetic evolution, although the two can interact. The distinct effects of the cultural, environmental, and genetic factors on cognitive and non-cognitive skills of an individual is at the core of a lively debate on "nature" versus "nurture", which is the object of study of several disciplines, from behavioral genetics to social sciences (for a survey, see Sacerdote, 2011).

With the growing evidence of the persistence of ethnic and religious traits across generations, cultural transmission has recently gained new emphasis in the theoretical and empirical literature. It has been documented how migrants generally struggle to maintain specific traits of the culture of the country of origin. The cultural renaissance of several ethnic and religious communities in the U.S. (Orthodox Jews, for example) apparently endangered, is a significant case. Similarly, Africa has witnessed the persistence of tribal distinctions even after the emergence of national institutions.[5] During the last decade, Bisin and Verdier (2000, 2001) have significantly extended existing models. In particular, they introduced the parental socialization choice, which is motivated by what they call imperfect empathy. In their framework, parents are altruistic and care about children's choices, which are however evaluated using the parents' preferences. Children acquire traits through their parents' socialization choices and by learning from the social environment in

[5] For a comprehensive review, see Bisin and Verdier (2005).

which they grow up. Parents choose the optimal socialization effort taking into consideration also the environment. Specifically, parental choices depend on the distribution of the population with respect to the relevant trait. Bisin et al. (2009) further extend this model by analyzing multi-trait populations. In our empirical analysis, we endeavor to reconcile vertical and horizontal socialization within the family by quantitatively estimating and distinguishing the roles of the intergenerational correlation (deemed to capture vertical socialization) and the residual siblings correlation (which is thought to embody horizontal socialization).

3 Analytical framework

Let the *observable* level of trust for father i at time t be:

$$Tf_{it} = Tf_{it}^{p} + vf_{it} \tag{1}$$

where Tf_{it}^{p} is his *permanent* level of trust at time t and vf_{it} is a zero mean *transient* shock uncorrelated over time and unrelated to past, current and future values of the permanent trust. To fix ideas, let the evolution of the *permanent* level of trust over time be driven by the following model:

$$Tf_{it}^{p} = \rho Tf_{it-1}^{p} + (1-\rho)uf_{it} \tag{2}$$

where uf_{it} is a *permanent* shock hitting Tf_{it}^{p} at time t. The permanent shock is uncorrelated over time and uncorrelated to past values of the permanent trust.

The intuition motivating this model is as follows. Tf_{it-1}^{p} is the level of *permanent* trust of father i at time $t-1$ summarizing past and current events relevant to his lasting belief on whether one can trust people. At time t he experiences the *unpredictable* shock (uf_{it}, vf_{it}). The component uf_{it} brings news relevant to the father's lasting belief, therefore updating his permanent trust according to equation (2). The component vf_{it} affects the *current* level of observable trust but does not bring any news relevant to the father's lasting belief. Accordingly, it does not leave any trace on the father's future belief.

With this simple framework we introduce two novel aspects. First, we distinguish between *observable* and *permanent* trust. Previous studies do not contemplate a transient component of trust, implicitly assuming that the transient shock vf_{it} is negligible. Presumably, only permanent trust is relevant for the intergenerational transmission, in that transient shocks – being uninformative about the updating process of father – are unlikely to be passed to the child. In the following, we will show that the latter is actually a testable implication of the model. Since the father's permanent trust is observable only through vf_{it}, the presence of a transient shock raises the classic measurement error problem to the purpose of the econometric identification of the intergenerational transmission.

The second aspect is that we delve into an important implicit assumption made in the existing literature, namely that trust is invariant over time. Empirically speaking, this assumption is rejected by the evidence we provide in Table 1. Still, it could be recast in our framework with reference to the permanent component of trust:

$$Tf_{it}^{p} = Tf_{it-1}^{p} = Tf_{i}^{p} \tag{3}$$

In the following, we show that this restriction has testable implications. Key to the feasibility of this test is the availability of panel data of individuals observed at least at *three* points in time.

The observable trust for mothers and children, Tm_{it} and Tc_{it}, their permanent trust, Tm_{it}^{p} and Tc_{it}^{p}, their transient and permanent shocks vm_{it}, vc_{it}, um_{it} and uc_{it}, as well as the equations linking permanent and observable trust and their dynamics are defined in the same manner as for fathers.

Turning to the transmission process, the equation relating the permanent trust of children to the *contemporaneus* permanent trust of their parents is:

$$Tc_{it}^{p} = \beta_0 + \beta_1 Tf_{it}^{p} + \beta_2 Tm_{it}^{p} + \epsilon_{it} \tag{4}$$

where the subscript t refers to the time at which the interview takes place. Note that information is collected at the same time for fathers, mothers and children. Our equation is similar to the one adopted in the existing literature on intergenerational transmission of trust, the important novelty being that in our framework we emphazise that it is the permanent trust which is passed on from parents to their children.

There are a number of issues one needs to carefully take into account in order to attach a structural interpretation to the coefficients in equation (4) and to consistently estimate them. Since in our dataset the permanent trust of children is observed (up to measurement errors) when they are at least 17 years old, modelling the mechanism of transmission from the early childhood to the late adolescence of children is not possible. This is a common and known limitation in this type of studies. However, a feasible and interesting alternative is to model the link between the level of permanent trust of children at age 17 – when the intergenerational transmission is presumably completed – and the trust that parents put in the process up to that time. This is a kind of reduced form model linking inputs to the outputs and silently skipping over the circumstances inside the black box of the transmission process.

Even when recasting the problem this way, several issues persist. First, the trust that parents input in the transmission process is the one that covers the years when transmission took place, *not* the one we observe at the time we collect our survey data. This implies that to achieve a meaningful structural interpretation of the parameters in equation (4), one needs to explicitly account for the dynamics of the permanent trust of parents over time.

Second, to our purposes, we should ideally use the trust of children exactly at age 17 (or just above 17), i.e., right at the age by when the transmission is presumably completed. To gain statistical precision, we instead include in our sample children of *any* age (see Section 4.1 for details on sample selection). Hence the trust we observe for children refers to their age at the time of the interview, and not at 17. The major implication is that one needs to explicitly account for the dynamics of the permanent trust from age 17 onwards.

The third issue relates to the fact that, even though parameters in equation (4) deserved a structural interpretation, their identification would be problematic if the permanent trust of children and of their parents were affected by correlated permanent shocks, since this would induce the endogeneity of the permanent trust of parents. Related to this, an additional potential issue could be a reverse causal link going from the trust of children to the trust of their parents. Both these cases of endogeneity would lead to inconsistent OLS estimates.

Importantly, however, there is at least one special case when all the issues above *do not* arise. If the permanent trust of parents and children were time invariant, this means that observing them (up to measurement errors) at the time of the survey would still provide a valid measure for both the permanent trust of parents when the transmission took place and the trust of children at age 17. Moreover, invariance of permanent trust would be sufficient to exclude the existence of permanent shocks, therefore ruling out the endogeneity of Tf_{it}^p and of Tm_{it}^p in equation (4). It is therefore crucial to test whether the hypothesis of trust invariance holds, before turning to the estimation of the transmission equation.

A fourth issue is that to obtain a *feasible* version of the transmission equation (4), one needs to replace the unobservable permanent trust of children and of their parents by their error-ridden observable counterparts:

$$Tc_{it} = \beta_0 + \beta_1 Tf_{it} + \beta_2 Tm_{it} + \epsilon_{it} + vc_{it} - \beta_1 vf_{it} - \beta_2 vm_{it} \tag{5}$$

This raises the problem of how to estimate this feasible equation taking into account the endogeneity problem raised by the measurement errors in the observable trust of parents (as well as by the possible correlation between the measurement errors of parents and of their children).

Last but not least, key to the identification of the structural parameters in equation (4) is controlling for possible confounders which could be correlated to the trust of parents and children. To deal with this issue, we check the sensitivity of the estimates of (5) to the inclusion of several observables.

To quantify the *strength* of the transmission process, we follow the standard practice in the literature on intergenerational transmission and consider the fraction of the variance of Tc^p explained by (Tf^p, Tm^p). This depends both on the size of the coefficients β_1 and β_2 and on the degree of correlation between the permanent trust of parents:

$$\beta_1^2 var\{Tf_{it}^p\} + \beta_2^2 var\{Tm_{it}^p\} + 2\beta_1\beta_2 cov\{Tf_{it}^p, Tm_{it}^p\}. \tag{6}$$

Distinguishing between observable and permanent trust is crucial to properly assess the extent to which children inherit trust from their parents. Even leaving aside the issue of how to estimate the coefficients β_1 and β_2 (see below Section 4.2), it is clear that the relevant R^2 should be evaluated with respect to the variance of Tc^p and not of Tc. Whether this distinction is important is an empirical issue to which we devote the next section, where we provide an estimate of the variance of the two components.

4 Econometrics

4.1 Data

Our *panel* of parents and children is drawn from the German Socio-Economic Panel (GSOEP). The GSOEP is a large longitudinal survey extensively used by economists and that has been the base for intergenerational studies (see, e.g., Dohmen et al., 2012). The survey was introduced in West Germany in 1984 and collected data on 12,000 households; in 1990, it was extended to include about 2,000 households from East Germany.[6] Two features of GSOEP are key to our study. First, the survey "tracks" individuals, which means that those who move internally in Germany can still be followed over time, thereby reducing attrition. Second, it provides indicators to match children with their biological parents inside the panel. This feature is essential in order to construct families and observe them over time. A family is defined as the parental couple (mother and father) and their biological child(ren). Given the structure of GSOEP it is not necessary for the family members to live in the same household in order to be observed in the panel.[7]

We included in the sample all couples who took part continuously into the survey in the waves 2003, 2008 and 2013 with at least one child of age 17 or older in 2013. Crucial to our analysis, this sample selection implies that we observe the trust of both parents in *three* time periods. The trust of children included in the sample is observed at least in 2013. For a subset of children, trust is also observable in either or both the previous waves (2003 and 2008) provided they were at least 17 and present during the survey (see Table A2 in the Appendix for details on the number of waves children are observed). The age distribution of fathers, mothers and children in 2013 is set in Figure 1.

[6] A detailed description of GSOEP data can be found in Wagner et al. (2007). The panel has been assembled using PanelWhiz, see Haisken-DeNew and Hahn (2010) for details.

[7] It is possible, however, that some children already left the households at the time of the first survey, and hence they are not part of the panel, despite being part of the family. Table 2 classifies families in terms of number of children who are part of the sample and total number of children (i.e., including those outside the sample).

The resulting panel comprises 1,652 children within 1,126 families. In the left panel of Table 2 we report the distribution of families by number of children included in our sample in 2013. The right panel reports the distribution of families by the *total* number of children in the same year. This total includes also children who are outside the sample (because they are still younger than 17, or because they were not originally sampled, or because of other reasons).

The key variable of our analysis is the *generalized trust*. This is recorded as the level of agreement with the statement "On the whole, one can trust people" on a four-point scale. From the GSOEP we derived additional variables, including gender, age, number of siblings, nationality, education and information on the place of residence when aged 15. We report summary statistics for these variables in Table A1 in the Appendix separately for mothers, fathers and children. We additionally include the average level of trust in the region, following the argument of Dohmen et al. (2012) that trust in the area of residence might affect children's trust or the transmission process.[8]

A remarkable aspect that emerges from a deeper inspection of the raw data – and not easily detectable with cross-sectional studies – is the variability of observed trust over time. Figure A1 in the Appendix shows the graphs of the difference in the level of trust for two consecutive waves, for both fathers and mothers. The graphs reveal that about 40% of parents report a different value of trust across two consecutive waves.

Additional evidence about this aspect comes from Table 1, where we report autocovariance matrices of trust for the three waves forming our sample. The results are reported separately for fathers, mothers and children and for whether we include or not additional covariates in the computation of the covariances.[9] A cursory inspection of these matrices immediately reveals that the observable trust is far from stable over time, complementing what observed in Figure A1. The autocorrelation of order one is in the range 0.35 - 0.44. This is in stark contrast with the assumption – implicit in the existing literature on the transmission of trust – that trust is stable over time. We argue that the low degree of persistence observed in our data is due to the *transient* component of trust, as defined in equation (1). The consequent issue is that we need to establish whether the *permanent* component of trust – i.e., the one relevant for the intergenerational transmission – is invariant over time. The evidence in Table 1 will be the basis for our test for the invariance of permanent trust over the years developed in the next Section.

4.2 Specification testing and estimation

The testable implication of the invariance condition (3) written with reference to fathers is:

[8]Our definition of region follows closely Dohmen et al. (2012), and consists of the 96 policy-regions of Germany (also known as RORs).

[9]In the model with controls, covariances are calculated using residuals from a regression of trust on the full set of covariates (see Table A1). Note that the number of children reported in the Table is smaller than the total available in the sample, since only children observed in all three waves are used in the calculation of the autocovariances.

$$cov\{Tf_{i2003}, Tf_{i2008}\} = cov\{Tf_{i2003}, Tf_{i2013}\} = cov\{Tf_{i2008}, Tf_{i2013}\}. \tag{7}$$

In words, if the permanent trust Tf_{it}^{p} does not vary over time and the variation over time of the observable trust Tf_{it} is only due to random shocks, then the covariance between the observable trust at time t and at time s equals the variance of the permanent trust for any choice of (t, s). That is, if the permanent trust is invariant over time, the three covariances in each panel of Table 1 should be equal (up to sampling variability).

Condition (7) could be violated due to different reasons. Particularly relevant to our case, it would not hold if the transient shocks were correlated at lag 1. It would also be violated if the equation driving the dynamics of Tf^{p} were as in equation (2). In both cases the covariance between observable trust in (2013, 2008) would be different from the corresponding covariance in (2013, 2003).

To implement the test, note that (7) is equivalent to:

$$cov\{Tf_{i2003}, Tf_{i2008} - Tf_{i2013}\} = cov\{Tf_{i2008}, Tf_{i2003} - Tf_{i2013}\} = cov\{Tf_{i2013}, Tf_{i2003} - Tf_{i2008}\} = 0. \tag{8}$$

To test the first condition, it is sufficient to perform the regression of $Tf_{i2008} - Tf_{i2013}$ on Tf_{i2003} (or the other way around) and check whether the regression coefficient is zero. The same applies for the remaining two conditions. Clearly, a panel of observations of at least length three is needed to perform this test.

On accepting the invariance condition (7), the decomposition of the variance of the observable trust into its components due to the permanent trust and to the transient shock, respectively, proceeds the following way.

$$var\{vf_{it}\} = var\{Tf_{it}\} - var\{Tf_{i}^{p}\}. \tag{9}$$

The variance of Tf_{i}^{p} follows from condition (7). To estimate the parameters of the feasible transmission equation (5), note that Tf_{it-1} and Tm_{it-1} are valid instrumental variables for Tf_{it} and Tm_{it} provided that the transient shock is not correlated over time. Also, note that with a panel of length three the model is *overidentified* since Tf_{it-2} and Tm_{it-2} are valid instruments as well.

These settings provide the basis for an additional test of the hypothesis of no autocorrelation of the transient shock. Under the alternative hypothesis of autocorrelated shocks, the IV at time $t-1$ is plausibly more correlated to the disturbance term in equation (5) than the IV at time $t-2$. Therefore, the Sargan overidentification test should detect a violation of the null hypothesis. The same test is in principle useful also to detect a violation of our conjecture that transient shocks of parents' trust are irrelevant for the transmission process. If these shocks were otherwise relevant, the exclusion restriction on our candidate IV would not hold since past values of parents' observable trust would matter for current values of children's observable trust, even conditional on the current values of parents' permanent trust. Since the degree of violation of the exclusion restriction is likely to vary with the lag of the instrument, the Sargan overidentification test should detect whether the null hypothesis does not hold.

To summarize the strength of the transmission of trust from parents to children we use the conventional R^2 of equation (4). The variance of Tc^p explained by the regression can be calculated according to expression (6). The variance of Tc^p_{it}, Tf^p_{it} and Tm^p_{it} are derived as a corollary of the invariance condition in Equation (7). A convenient way to recover the covariance between the permanent trust of parents is to preform a regression of Tf_{it} on Tm_{it} using Tm_{it-1} as an IV to eliminate the bias due to the measurement error. This is a consistent estimate of the regression coefficient of Tf^p_{it} on Tm^p_{it}. The next step is to rescale the estimated coefficient by $var\{Tm^p_{it}\}$ to obtain the covariance between the trust of parents.

4.3 Sibling correlation in trust

To investigate further on the role of the family environment in the transmission process, we exploit the variation stemming from families with more that one child in the sample – which are about 38% of our sample (see Table 2). The availability of siblings in the data allows to estimate a transmission equation which includes a family specific unobservable effect. This can be achieved by estimating a modified version of equation (4):

$$Tc^p_{ij} = \beta_0 + \beta_1 Tf^p_{ij} + \beta_2 Tm^p_{ij} + \alpha_j + \epsilon_{ij} \tag{10}$$

The subscript ij refers to children belonging to the same family j (we drop the time suffix to ease the exposition). Similarly to Bingley and Cappellari (2012), we identify both the parental and sibling effects by estimating intergenerational and sibling correlations within a unified framework. The residual sibling effect α_j includes parental influences not captured by the direct transmission of trust, as well as other environmental factors shared by siblings that are independent from the parents. Schools, friendship networks and other circumstances operating at the community level are examples of this residual sibling effect. Note that our framework allows us to identify the direct transmission of trust from parents to children, but not *other* channels of intergenerational transmission of trust that are independent from parents' trust.

There are two important remarks about the identification of $var\{\alpha_j\}$ and its interpretation. First, since the identification of the variance is based on the between-siblings covariance of the residuals from the feasible IV regression of Tc on Tf and Tm, $var\{\alpha_j\}$ could partially capture the correlation between the transient shocks of siblings. However, this is a testable implication. Under the null hypothesis of no correlation between the transient shocks of siblings, the covariance between the trust of one sibling in 2013 and the trust of another sibling at, say, time t, does not depend on t since it is equal to the covariance between the permanent trust of the two siblings. We implement this test in the same way as in equation (8).

Second, $var\{\alpha_j\}$ strictly refers to families with at least two children in the sample (about 38%). Note, however, that the overall (i.e., including out of sample) number of siblings – and thus of families with more than one child – is much larger. The second panel of Table 2 shows that nearly 85% of the families in our sample have more than one child, meaning that the estimate of $var\{\alpha_j\}$ is virtually representative of the majority of our sample.

5 Results

5.1 Testing for invariance of permanent trust

Table 3 presents the results of the test for invariance of permanent trust separately for fathers, mothers and children. The pattern of autocovariance for mothers and children provides clear evidence that observable trust is equal to a time invariant component plus a random shock. This result holds true even after stratifying by age (with the exception of few correlations statistically significant at the 10% level). On the other hand, the null hypothesis is rejected for fathers. By inspecting again Table 1, it is clear that this violation is driven by the difference between $cov\{Tf_{i2013,Tf_{i2008}}\}$ and $cov\{Tf_{i2013,Tf_{i2003}}\}$. Table 3 further shows that the null hypothesis is rejected for relatively old fathers, but not for younger fathers. This result is unaffected by the inclusion of the full set of regressors. We will take into account the results of the invariance tests in the analysis of transmission of trust.

The most important consequence of the tests in Table 3 for the identification of the transmission parameters is that by age 17 (and above) – i.e., the age at which the transmission of trust is presumably completed – the permanent trust of children is *not* affected by permanent shocks (at least over the time span 2003 to 2013), irrespectively of their age. Even if, given the available data, it is not possible to directly test whether this occurs also at ages before 17, we proceed in our analysis maintaining that in Equation (4) there is no endogeneity of Tf^p and Tm^p attributable to permanent shocks correlated between parents and children.

Table 4 presents the decomposition of the variance of observable trust into the permanent trust and transient shock components. The main aspect is that for mothers and children the permanent trust accounts for approximately *one third* of the variance of the observed trust, while the remaining is attributable to the noise of the transient shock. This fraction is slightly larger for fathers, and accounts for about half of the variance of the observable trust.

5.2 Estimating the transmission parameters

Table 5 presents the results of the estimation of the feasible transmission equation (5). We report estimations for OLS and IV models; for the latter we estimate both regression pooling together all siblings and one with a family random effect. The instruments used are the first and second lag of trust for both fathers and mothers. The validity of our instruments is supported by the absence of autocorrelation of the transient shocks, for which we provided evidence (for mothers and younger fathers) in the previous section. The Durbin-Wu-Hausman test strongly rejects the hypothesis of exogeneity of Tf and Tm while the Sargan overidentification test does not reject the null hypothesis adding further evidence in favor of the validity of our assumption of no autocorrelation for the transient shock.

Despite the usual loss of precision, the IV estimate for the coefficient of mothers is strongly significant and three times larger than the OLS estimate. On the other hand, the estimate for the coefficient of father is remarkably similar to the OLS (with the latter being estimated with higher precision). This pattern holds for both models with and without full controls. To corroborate this result, we replicated the regression on the subsample that contains fathers of age below the median, i.e., those for which there is no evidence of violation of the restriction of permanent trust invariance. Results are essentially unaffected, even if the effect of mothers is even stronger – see Table A4.

The evidence that accounting for measurement errors makes a major difference for the estimated coefficient for mothers while it does not matter at all for the estimated coefficient for fathers might seem puzzling. In the Appendix we show in fact that this is in line with known results in the literature on measurement errors, according to which when both regressors are affected by measurement errors, the sign of the resulting bias is a priori uncertain.

We also replicated the analysis by splitting the sample by gender of the child (Table A5 in the Appendix). Results are qualitatively similar to the baseline, although the effect of mother's trust is stronger for female children.

The key result of this analysis is that a clear hierarchy emerges in the roles of mothers and fathers with the formers being more influential in the transmission process. The order of magnitude of the estimated coefficients are in line with those found by Dohmen et al. (2012), even if our results show a sharper difference between mothers' and fathers' roles.

As for the strength of the intergenerational transmission, we summarize it as the fraction of the variance of Tc_{it}^p explained by the permanent trust of parents. As a first step, we estimate the strength of the correlation between the permanent trust of fathers and mothers as outlined at the end of the previous section. The IV estimate of the regression of Tf^p on Tm^p is approximately equal to the correlation coefficient between the two variables and is 0.647 (s.e. 0.076) for the model without controls and 0.571 (s.e. 0.081) for the model with full controls.[10]. The R^2 pertinent to the transmission process is about 0.23 in the model without controls and drops to 0.17 in the model with full controls. In words, this means that a large fraction of the variability in the permanent trust of children is *not* attributable to the parents' permanent trust. Failing to distinguish between

[10]Recall that the variance of Tf^p is approximately equal to the variance of Tm^p - see Table 4.

permanent trust and transient shocks would result in a severe underestimation of the strength of the transmission process.

Turning to the results of the random effect specifications, we notice that the pattern of estimates are similar to the IV model estimated without considering sibling correlations. The striking result, however, lies in the estimated contribution of the family-specific unobservable a_j component to the variance of Tc^p. The ratio of $var\{\alpha_j\}$ to $var\{Tc^p\}$ is *three* times larger than the contribution of the parents' permanent trust. This effect becomes slightly larger when controls are included. Taken together, family-specific characteristics – whether observable (permanent trust) or unobservable (α_j) – account for nearly 90% of the variance of children's permanent trust. [11]

Table A6 in the Appendix shows that the sibling correlation estimate is not biased by the correlation between transient shocks of siblings. Only one out of the six tests rejects the null hypothesis, and only at the 10% significance level.

The empirical relevance of α_j in Equation (10) casts suspicion about a possible omitted variable bias in the estimation of the coefficients of parents' permanent trust. However, note that such bias would not affect the overall quantitative relevance about the family-specific characteristics to the transmission process.

6 Discussion

In Table 6, we present the decomposition of the variance of the trust of children in 2013. Two striking facts emerge. First, the observed variability of the children's trust is dominated by random shocks – nearly two thirds of the total variance. On the other hand, permanent trust explains the remaining one third. Note, we identify the size of these components by exploiting the longitudinal variation of trust.

Second, less than one fourth of the variance of children's *permanent* trust is attributable to the direct transmission of permanent trust from parents. We identify the size of this component by exploiting the correlation between children's and parents' trust (accounting for the attenuation bias due to transient shocks).

Approximately two thirds of the variance of children's permanent trust is attributable to residual sibling correlations. This captures characteristics of the environment – within or outside the family – which are shared by siblings. In principle, also this component might include intergenerationally-transmitted trust through channels that work independently from parents' trust.

Overall, direct transmission of trust from parents and residual sibling correlations account for just less than 90% of the variance of the permanent trust of children. Even if the evidence we provide emphasizes the major role played by the family environment in shaping children's trust, it

[11] The inclusion of controls in the regression yields similar results, with only marginal changes in the relative contribution of the parents' permanent trust and of α_j.

is clear that the direct transmission from parents plays a minor role in the persistence of trust over generations.

One challenge is how to reconcile our evidence with some results coming from the literature on long term persistence of trust. For example, Guiso et al. (2008a) show that the establishment of free cities in Center-North Italy during the medieval period generated a positive shock in the accumulation of social capital in the affected municipalities which is perceivable even nowadays. In a companion paper, the authors develop a theoretical model to show how the intergenerational transmission of trust is compatible with their empirical evidence (Guiso et al., 2008b).

A possible argument to reconcile our evidence of a weak "short run" intergenerational transmission effect with the results by Guiso et al. (2008a) comes from the literature on intergenerational mobility of income and wealth. Building on Güell et al. (2015), Barone and Mocetti (2016) argue that intergenerational mobility of earnings up to the end of the 19th century in Florence might have been much lower than what observed today. The authors put forward the idea that in less mobile societies like those prevailing in the pre-industrial era, intergenerational transmission took place thanks to a variety of social institutions and not only through the direct parent-child transmission. Additional arguments postulating the environment as a driver of the long term persistence of trust come from simple models of cultural transmission (see the review in Bisin and Verdier, 2011). In these models, if trust is not vertically transmitted, the child draws it at random from the population. Our results suggest a possible "amendment" to these frameworks: the random draw from the population is sibling-specific rather than being individual-specific, i.e., it affects in the same manner the trust of children who grew up in the same family environment.

7 Summary and conclusion

We study the intergenerational transmission of trust using a sample of parents and children drawn from the German Socio-Economic Panel. Our key asset is the availability of longitudinal information, which is crucial to distinguish between two different ways the family might shape children's trust: the direct transmission from parents to children and the influence exerted by a broadly defined family environment shared by siblings, such as parental influences not captured by the direct transmission of trust, as well as other local effects shared by siblings and that are independent on the parents (e.g. schools, friendship networks or other factors operating at the community level).

Longitudinal information is also essential in order to disentangle the two components of observable trust, namely permanent trust and transient shock. This distinction is vital because it is plausible to postulate that parents transmit to their children only their permanent trust, i.e., their lasting belief on whether one can trust other people, while the transient shock – being temporary by construction – is unlikely to be passed to the children. Our argument is akin to the point made by Solon et al. (1991) in their analysis of intergenerational transmission of economic status. We show that permanent trust only accounts for *one third* to *a half* of the observed cross sectional variability of trust. To the purpose of the econometric identification of the transmission parameters, the remaining part of the variability rises the classic measurement error problem.

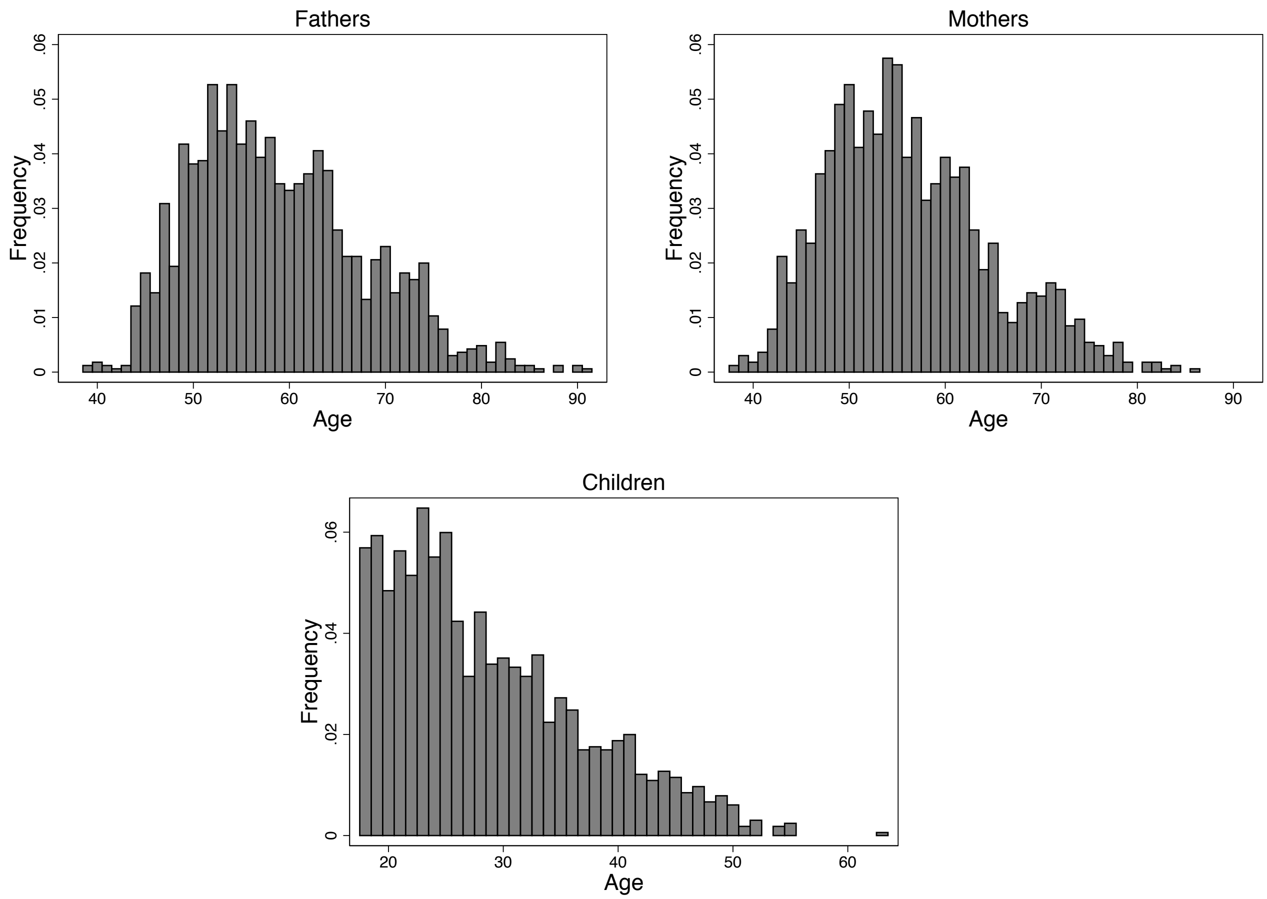
Next, with our panel data we can test the invariance of trust over time – an important assumption which is implicitly maintained in the previous literature but that has not been proven empirically before. In particular, we show that permanent trust is invariant for mothers and for children over the time window 2003 to 2013, while this holds true only for younger fathers.

Based on the evidence that permanent trust is invariant, we model the relationship between the permanent trust of children and the contemporaneous permanent trust of their parents. The structural interpretation that we give to the parameters of this equation is that they capture the link between the trust that parents input in the transmission process (up to when their children are 17 year old) and the level of permanent trust of their children at the time the transmission is completed. The estimation of these structural parameters requires replacing the unobservable permanent trust of children and of their parents by their error-ridden observable counterpart. The importance of having longitudinal information is once again evident since we can use the lag trust of parents as a valid instrumental variable to mitigate the measurement error problem. The remarkable result that transpires is that mothers play a stronger role than fathers in the transmission process. This result is in line with previous findings (see, for instance, Dohmen et al., 2012), but the difference found in the parental roles is stronger.

Finally, exploiting the availability of families with more than one child in our sample, we estimate the variance of the unobservable family-specific effect which is thought to represent additional environmental factors shared by the siblings and relevant to their permanent trust. The variance explained by this component is *three* to *four* times larger than the variance explained by the permanent trust of parents. Taken together, the intergenerational correlation and the residual sibling correlation account for approximately 90% of the variance of the permanent trust of children. In conclusion, while the family environment in which children grew up determines most of their *permanent* trust, the direct role of intergenerational transmission is rather exiguous.

Tables and Figures

Figure 1: Age distribution in 2013



Source: GSOEP waves 2003, 2008 and 2013.

Table 1: Autocovariance matrices for observable trust

	Fathers			**Mothers**			**Children**		
	No controls								
	2003	2008	2013	2003	2008	2013	2003	2008	2013
2003	0.4400	0.1688	0.1381	0.4057	0.1351	0.1358	0.4409	0.1307	0.1262
2008		0.4370	0.1698		0.4112	0.1445		0.3761	0.1334
2013			0.3908			0.3805			0.3585
	With controls								
	2003	2008	2013	2003	2008	2013	2003	2008	2013
2003	0.4043	0.1416	0.1108	0.3802	0.1157	0.1171	0.4038	0.1120	0.1012
2008		0.4034	0.1432		0.3819	0.1242		0.3496	0.1118
2013			0.3530			0.3490			0.3235
N		1126			1126			798	

Source: GSOEP waves 2003, 2008 and 2013

Sample is composed by fathers, mothers and children for whom trust is observed in all three waves.

The sample of children in the table is smaller than the number used in the analyses (N=1652) since some children turn 17 after 2003 and a few others were added to GSOEP in waves subsequent to 2003.

Control variables include for parents and children: age, education (No Degree or In School / Secondary School Degree / Intermediate School Degree / Technical, Upper Secondary or Other Degree), nationality (German / foreign), number of siblings, place where raised up to age 15 (unreported / small city / medium city / large city / countryside). For children, gender and the average level of trust in the ROR in 2013 are also included.

Table 2: Distribution of families by number of children

Number of children	Sample		Overall	
	Frequency	Percentage	Frequency	Percentage
1	699	62.08	176	15.63
2	349	30.99	576	51.15
3	59	5.24	249	22.11
4	17	1.51	89	7.90
5	2	0.18	24	2.13
6 or more	-	0	12	1.07
Total	1126	100	1126	100

Source: GSOEP wave 2013.

Sample is composed by families with fathers and mothers for whom trust is observed in all three waves and with children for whom trust is observed at least in wave 2013.

The first and second column refer to the distribution of families in the sample by the number of children included in the sample reported in 2013. The third and fourth column refer to the distribution of families by the overall number of children (i.e., including also children outside the sample) reported in 2013. The number of children in each family is calculated using information on the number of siblings reported by the children in the sample.

Table 3: Invariance of permanent trust

Dep. Variable	**Main regressor**	*No controls* **Fathers**	**Mothers**	**Children**	*With controls* **Fathers**	**Mothers**	**Children**
		All age groups					
$T_{2013} - T_{2003}$	T_{2008}	0.0025	0.0227	0.0070	0.0040	0.0223	–0.0006
		(0.0371)	(0.0385)	(0.0493)	(0.0393)	(0.0386)	(0.0513)
$T_{2013} - T_{2008}$	T_{2003}	–0.0697**	0.0017	–0.0104	–0.0761**	0.0037	–0.0267
		(0.0344)	(0.0365)	(0.0413)	(0.0354)	(0.0365)	(0.0429)
$T_{2008} - T_{2003}$	T_{2013}	0.0813**	0.0227	0.0201	0.0917**	0.0203	0.0328
		(0.0359)	(0.0374)	(0.0498)	(0.0387)	(0.0394)	(0.0512)
N		1126	1126	798	1126	1126	798
		Below median age					
$T_{2013} - T_{2003}$	T_{2008}	–0.0041	–0.0394	0.0218	–0.0123	–0.0466	0.0097
		(0.0489)	(0.0535)	(0.0664)	(0.0501)	(0.0532)	(0.0694)
$T_{2013} - T_{2008}$	T_{2003}	–0.0523	–0.0158	–0.0715	–0.0560	–0.0076	–0.0747
		(0.0458)	(0.0504)	(0.0546)	(0.0477)	(0.0514)	(0.0588)
$T_{2008} - T_{2003}$	T_{2013}	0.0606	–0.0265	0.1168*	0.0572	–0.0440	0.1093
		(0.0501)	(0.0532)	(0.0661)	(0.0528)	(0.0579)	(0.0721)
N		602	584	418	602	584	418
		Above median age					
$T_{2013} - T_{2003}$	T_{2008}	0.0171	0.0994*	–0.0119	0.0135	0.1091*	–0.0260
		(0.0569)	(0.0542)	(0.0734)	(0.0636)	(0.0556)	(0.0790)
$T_{2013} - T_{2008}$	T_{2003}	–0.0863*	0.0247	0.0620	–0.1224**	0.0346	0.0399
		(0.0516)	(0.0523)	(0.0625)	(0.0571)	(0.0532)	(0.0685)
$T_{2008} - T_{2003}$	T_{2013}	0.1041**	0.0782	–0.0832	0.1361**	0.0787	–0.0740
		(0.0516)	(0.0524)	(0.0766)	(0.0570)	(0.0560)	(0.0821)
N		524	542	380	524	542	380

Source: GSOEP waves 2003, 2008 and 2013.
*/**/*** indicate significance at the 0.1/0.05/0.01 level.
Sample is composed by fathers, mothers and children for whom trust is observed in all three waves.
The sample of children in the table is smaller than the number used in the analyses (N=1652) since some children turn 17 after 2003 and a few others were added to GSOEP in waves subsequent to 2003.

Table 4: Variances of permanent trust and transient shock

	Permanent trust		Transient shock	
	No controls			
	2003	2008	2003	2008
Fathers	0.2063	0.2076	0.2338	0.2294
Mothers	0.1344	0.1437	0.2712	0.2675
Children	0.1355	0.1382	0.3055	0.2379
	With controls			
	2003	2008	2003	2008
Fathers	0.1809	0.1830	0.2234	0.2204
Mothers	0.1143	0.1227	0.2659	0.2592
Children	0.1239	0.1237	0.2798	0.2259

Source: GSOEP waves 2003, 2008 and 2013
Sample is composed by fathers, mothers and children for whom trust is observed in all three waves
Permanent trust derived using Equation (9) under accepting the invariance condition in Equation 7 and the covariances from Table 1.

Table 5: Intergenerational transmission

	No controls			*With controls*		
	OLS	**IV**	**IV R.E.**	**OLS**	**IV**	**IV R.E.**
Father's trust	0.1044***	0.1041	0.1025	0.0801***	0.0755	0.0725
	(0.0272)	(0.0768)	(0.0814)	(0.0271)	(0.0776)	(0.0833)
Mother's trust	0.1254***	0.3523***	0.3668***	0.0985***	0.3271***	0.3444***
	(0.0286)	(0.0834)	(0.0890)	(0.0294)	(0.0850)	(0.0911)
Constant	1.7541***	1.2303***	1.2016***	0.7485	0.6492	0.5418
	(0.0742)	(0.1439)	(0.1463)	(0.4586)	(0.4620)	(0.4697)
Partial R^2 Eq F.		0.129	0.122		0.124	0.118
Partial R^2 Eq M.		0.113	0.108		0.113	0.108
F-stat Eq F.		57.097	58.637		47.720	48.220
F-stat Eq M.		48.672	53.066		42.417	46.500
DWH χ^2		22.2109	22.8482		17.5280	18.2152
p-value Sargan		0.2568	0.2342		0.2211	0.2259
$R^2(Tf^p, Tm^p)$	0.0581	0.2166	0.2287	0.0324	0.1563	0.1676
$R^2(a_j)$			0.6549			0.6927
N families			1126			1126
N	1652	1652	1652	1652	1652	1652

Source: GSOEP waves 2003, 2008 and 2013.
*/**/*** indicate significance at the 0.1/0.05/0.01 level.
Sample is composed by fathers and mothers for whom trust is observed in all three waves and children for whom trust is observed in wave 2013.
OLS: Ordinary least squares; IV: Instrumental variable; IV R.E.: Instrumental variable with random effects. In the IV models, observable trust of fathers and mothers in 2013 is instrumented by their observable trust in 2008 and 2003.
Partial R^2 refers to the Shea's partial R-squared of the first stages.
F-stat refers to the F-statistic for the joint significance of the instruments in the first stages.
p-val Sargan indicates the p-value of the Sargan test for overidentification.
DWH χ^2 refers to the Durbin-Wu-Hausman test for endogeneity.
$R^2(Tf^p, Tm^p)$ refers to the unfeasible regression for the permanent trust. See Equation (4).
$R^2(a_j)$ refers to the variance explained by unobservable characteristics of the family.

Table 6: Decomposition of observed variance of children in 2013

	No controls	*With controls*
Variance of observable trust in 2013	0.3585	0.3235
Variance of transient shock*	0.2379	0.2259
Variance of Tc^p	0.1206	0.0976
Intergenerational transmission	0.0276	0.0164
Household environment	0.0790	0.0676
Residual component	0.0140	0.0136

Source: GSOEP waves 2003, 2008 and 2013
Sample is composed by children for whom trust is observed in 2013.
*The variance of the transient shock in 2013 is not identifiable and is thus replaced by the variance in 2008.
Components estimated using (9) and results from regressions in Table 5.

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Appendix - Tables and Figures

Table A1: Summary statistics

	Children	Fathers	Mothers
Trust: 2013	2.2912	2.368	2.3372
	(0.6172)	(0.6227)	(0.6347)
Trust: 2008^{+}	2.3511	2.3874	2.3372
	(0.624)	(0.654)	(0.6347)
Trust: 2003^{++}	2.3679	2.3565	2.3341
	(0.6637)	(0.6535)	(0.6359)
Males*	0.5097	1	0
	(0.5001)	(0)	(0)
Age	28.7464	58.8469	56.1858
	(8.4223)	(8.91)	(8.4305)
Number of siblings	1.5145	2.0048	2.1483
	(1.0897)	(1.734)	(1.7952)
German national*	0.9643	0.9437	0.9395
	(0.1856)	(0.2306)	(0.2385)
Education: No Degree/In School*	0.1907	0.0212	0.026
	(0.393)	(0.144)	(0.1593)
Education: Secondary School Degree*	0.112	0.3493	0.2869
	(0.3154)	(0.4769)	(0.4525)
Education: Intermediate School Degree*	0.2669	0.2887	0.4201
	(0.4425)	(0.4533)	(0.4937)
Education: Technical/Upper Secondary/Other Degree*	0.4304	0.3408	0.2669
	(0.4953)	(0.4741)	(0.4425)
Place raised at 15: Unreported*	0.1659	0.1822	0.1901
	(0.3721)	(0.3861)	(0.3925)
Place raised at 15: Large city*	0.1992	0.1489	0.1562
	(0.3995)	(0.3561)	(0.3631)
Place raised at 15: Medium city*	0.2488	0.2312	0.2191
	(0.4324)	(0.4217)	(0.4138)
Place raised at 15: Small city*	0.3087	0.4195	0.4159
	(0.4621)	(0.4936)	(0.493)
Place raised at 15: Countryside*	0.0775	0.0182	0.0188
	(0.2674)	(0.1336)	(0.1357)
N		1652	

Source: GSOEP waves 2003, 2008 and 2013.
Sample is composed by fathers and mothers for whom trust is observed in all three waves and children for whom trust is observed in wave 2013.
* refers to dummy variables.
$^{+}$ trust is calculated on the subsample of 1179 children for whom trust is observed in 2013 and in 2008; $^{++}$ trust is calculated on the subsample of 810 children for whom trust is observed also in 2013 and 2003.

Table A2: Structure of the panel

	Number of waves		
	1	2	3
Trust: Children, 2013	2.295	2.2926	2.2882
	(0.6526)	(0.6131)	(0.5987)
Trust: Fathers, 2013	2.2777*	2.4173	2.396
	(0.6367)	(0.5881)	(0.6265)
Trust: Fathers, 2008	2.3557	2.4427	2.3784
	(0.6751)	(0.6526)	(0.6412)
Trust: Fathers, 2003	2.3514	2.3766	2.3496
	(0.6901)	(0.6354)	(0.641)
Trust: Mothers, 2013	2.269	2.3181	2.3333
	(0.6336)	(0.5652)	(0.619)
Trust: Mothers, 2008	2.282*	2.3562	2.3596
	(0.6382)	(0.6106)	(0.6433)
Trust: Mothers, 2003	2.3297	2.3613	2.3233
	(0.6425)	(0.6322)	(0.6342)
N	461	393	798

Source: GSOEP waves 2003, 2008 and 2013.
Columns header refers to the number of waves children are observed. 1 means that children are observed only in 2013; 2 means that children are observed in 2013 and in 2008 or in 2013 and in 2003; 3 means that children are observed across the three waves
* indicates that trust values are significantly different with respect to those pertinent to the subsample of children observed across the three waves (i.e. p-values of a t-test for the difference of two means are below 0.05).

Table A3: Correlation between transient shocks - parents/children

Dep. Variable	**Main regressor**	*No controls* **Fathers**	*No controls* **Mothers**	*With controls* **Fathers**	*With controls* **Mothers**
		All age groups			
$T_{2013} - T_{2003}$	Tc_{2013}	0.0516*	–0.0035	0.0450	–0.0168
		(0.0294)	(0.0305)	(0.0298)	(0.0307)
$T_{2013} - T_{2008}$	Tc_{2013}	0.0148	0.0115	0.0067	0.0050
		(0.0278)	(0.0308)	(0.0282)	(0.0312)
$T_{2008} - T_{2003}$	Tc_{2013}	0.0368	–0.0150	0.0384	–0.0217
		(0.0284)	(0.0319)	(0.0285)	(0.0327)
N		1652	1652	1652	1652
		Below median age			
$T_{2013} - T_{2003}$	Tc_{2013}	0.0323	–0.0409	0.0322	–0.0573
		(0.0387)	(0.0382)	(0.0389)	(0.0394)
$T_{2013} - T_{2008}$	Tc_{2013}	0.0063	–0.0391	0.0178	–0.0431
		(0.0360)	(0.0383)	(0.0372)	(0.0389)
$T_{2008} - T_{2003}$	Tc_{2013}	0.0259	–0.0018	0.0143	–0.0142
		(0.0373)	(0.0404)	(0.0367)	(0.0413)
N		891	875	891	875
		Above median age			
$T_{2013} - T_{2003}$	Tc_{2013}	0.0796*	0.0446	0.0569	0.0191
		(0.0451)	(0.0492)	(0.0448)	(0.0497)
$T_{2013} - T_{2008}$	Tc_{2013}	0.0291	0.0773	–0.0152	0.0428
		(0.0434)	(0.0499)	(0.0426)	(0.0509)
$T_{2008} - T_{2003}$	Tc_{2013}	0.0505	–0.0327	0.0721*	–0.0237
		(0.0439)	(0.0513)	(0.0430)	(0.0526)
N		761	777	761	777

Source: GSOEP waves 2003, 2008 and 2013.
*/**/*** indicate significance at the 0.1/0.05/0.01 level.
Sample is composed by fathers and mothers for whom trust is observed in all three waves and children for whom trust is observed in wave 2013.

Table A4: Intergenerational transmission - fathers bwlow median age

	No controls			*With controls*		
	OLS	**IV**	**IV R.E.**	**OLS**	**IV**	**IV R.E.**
Father's trust	0.1053***	0.0093	–0.0027	0.0990**	–0.0017	–0.0204
	(0.0401)	(0.1155)	(0.1197)	(0.0409)	(0.1185)	(0.1251)
Mother's trust	0.1116***	0.4715***	0.5045***	0.0859**	0.4562***	0.4978***
	(0.0409)	(0.1225)	(0.1300)	(0.0428)	(0.1241)	(0.1315)

Source: GSOEP waves 2003, 2008 and 2013.
*/**/*** indicate significance at the 0.1/0.05/0.01 level.
Sample is composed by fathers and mothers for whom trust is observed in all three waves The sample is further reduced to only fathers with age below the median and children for whom trust is observed in wave 2013.
OLS: Ordinary least squares; IV: Instrumental variable; IV R.E.: Instrumental variable with random effects. In the IV models, observable trust of fathers and mothers in 2013 is instrumented by their observable trust in 2008 and 2003.

Table A5: Intergenerational transmission - by gender

	No controls			*With controls*		
			Males			
	OLS	**IV**	**IV R.E.**	**OLS**	**IV**	**IV R.E.**
Father's trust	0.1350***	0.1203	0.1269	0.1182***	0.0935	0.0935
	(0.0365)	(0.1242)	(0.1266)	(0.0388)	(0.1301)	(0.1328)
Mother's trust	0.0963**	0.3034**	0.3009**	0.0856**	0.2660**	0.2660**
	(0.0407)	(0.1306)	(0.1326)	(0.0431)	(0.1297)	(0.1325)
			Females			
	OLS	**IV**	**IV R.E.**	**OLS**	**IV**	**IV R.E.**
Father's trust	0.0761**	0.0989	0.0637	0.0414	0.0684	0.0520
	(0.0386)	(0.0906)	(0.0936)	(0.0371)	(0.0897)	(0.0936)
Mother's trust	0.1536***	0.3994***	0.4494***	0.1168***	0.3629***	0.3955***
	(0.0383)	(0.1026)	(0.1054)	(0.0383)	(0.1024)	(0.1063)

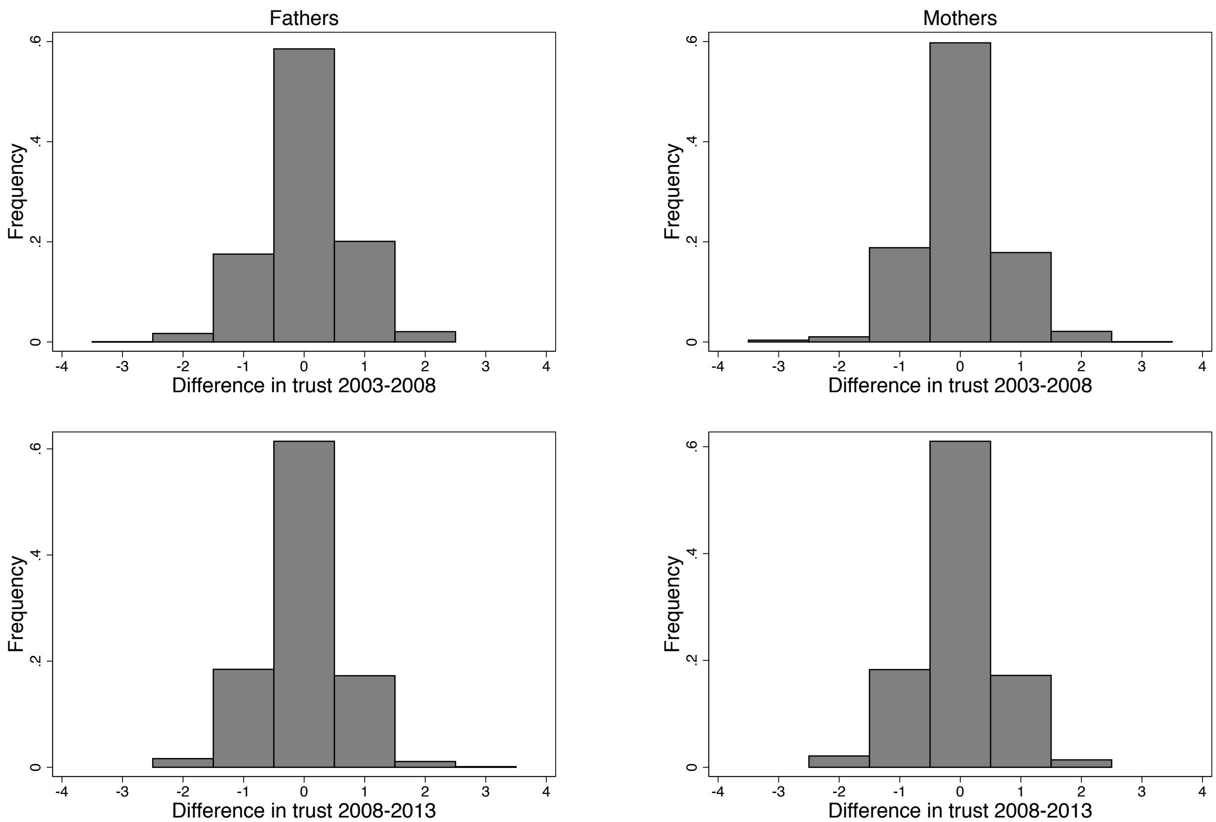
Source: GSOEP waves 2003, 2008 and 2013.
*/**/*** indicate significance at the 0.1/0.05/0.01 level.
Sample is composed by fathers and mothers for whom trust is observed in all three waves and children for whom trust is observed in wave 2013.
OLS: Ordinary least squares; IV: Instrumental variable; IV R.E.: Instrumental variable with random effects. In the IV models, observable trust of fathers and mothers in 2013 is instrumented by their observable trust in 2008 and 2003.

Table A6: Correlation between transient shocks - siblings

Dep. Variable	**Main regressor**	*No controls* **Sibling 1**	**Sibling 2**	*With controls* **Sibling 1**	**Sibling 2**
$T_{2013} - T_{2003}$	Tc_{2013}	–0.1079	–0.0497	–0.0820	0.0056
		(0.0998)	(0.1044)	(0.1358)	(0.1318)
$T_{2013} - T_{2008}$	Tc_{2013}	0.0664	0.1399	0.0898	0.1767
		(0.0930)	(0.0964)	(0.1075)	(0.1156)
$T_{2008} - T_{2003}$	Tc_{2013}	–0.1743	–0.1896*	–0.1718	–0.1711
		(0.1057)	(0.1105)	(0.1400)	(0.1281)
N		163	163	163	163

Source: GSOEP waves 2003, 2008 and 2013.
*/**/*** indicate significance at the 0.1/0.05/0.01 level.
Sample is composed by N pairs (326 individuals) of children observed in families where there are at least two siblings in 2013 and for whom trust is observed. Pairs are formed by the two youngest siblings. Sibling 1 (2) indicates that the dependent variable refers to the youngest (second youngest) sibling and the main regressor refers to the second youngest (youngest) sibling. Controls include all covariates for both siblings and for the parents. We include only once control variables that are highly collinear between siblings (nationality, number of siblings, place of living at age of 15 and average trust in the region of residence)

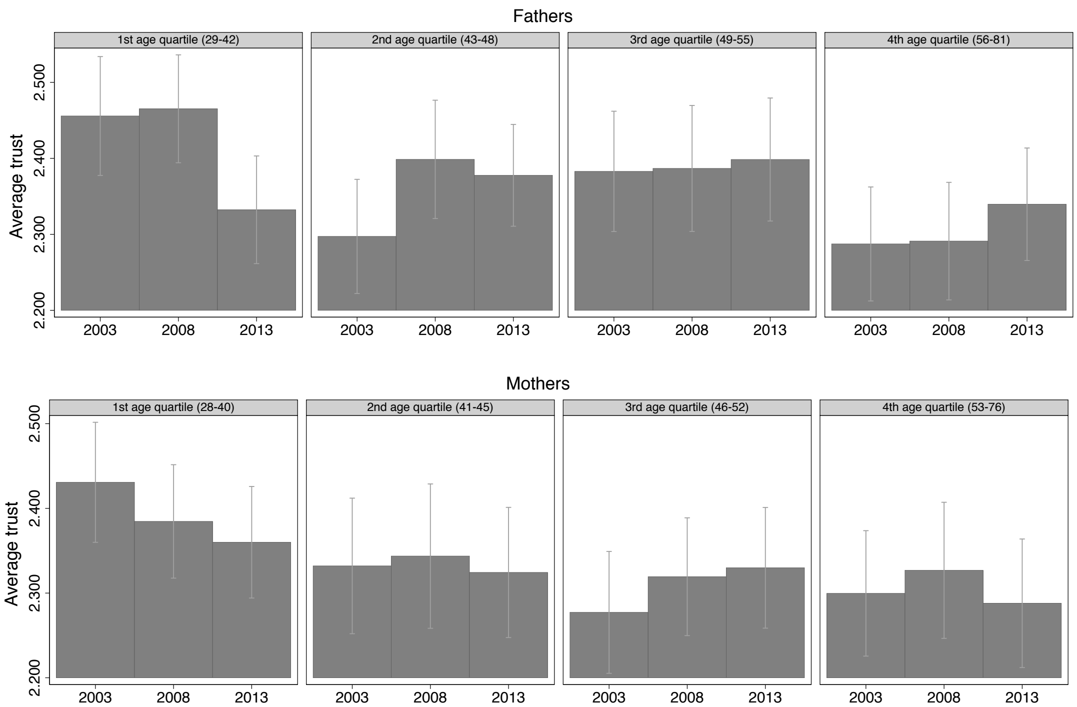
Figure A1: Difference in parental trust over time



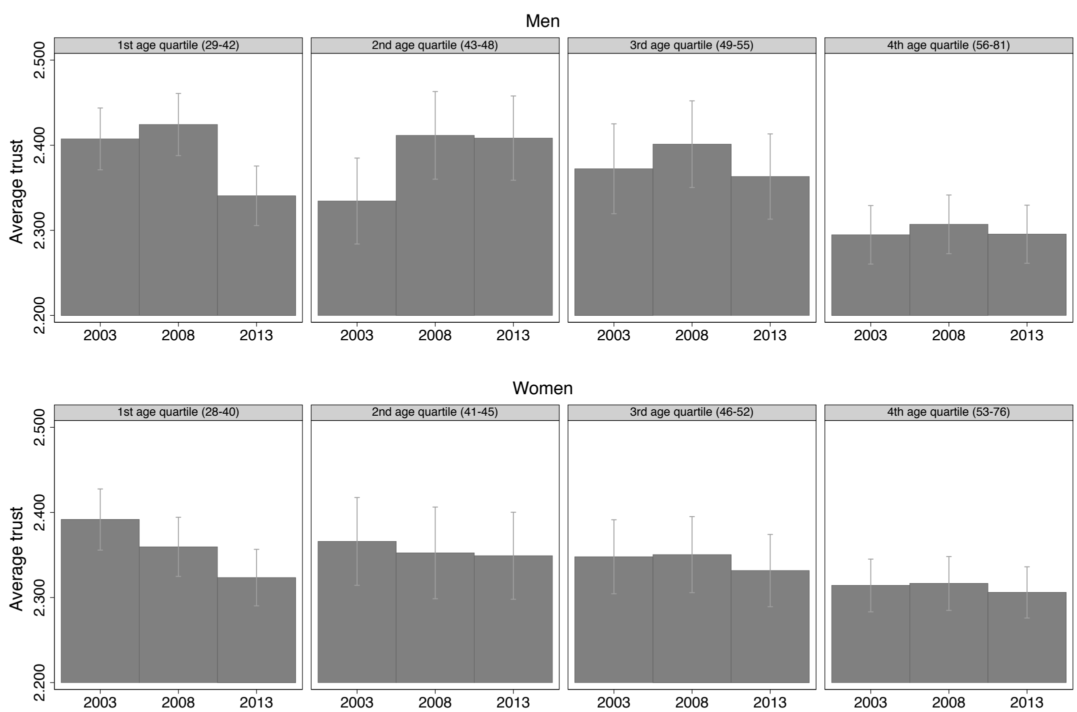
Source: GSOEP waves 2003, 2008 and 2013.

Figure A2: Trust over the life cycle

Sample



GSOEP



Source: GSOEP waves 2003, 2008 and 2013.

Appendix - Econometrics

A1 Measurement error bias with two explanatory variables

In the transmission equation:

$$Tc_{it}^{p} = \beta_0 + \beta_1 Tf_{it}^{p} + \beta_2 Tm_{it}^{p} + \epsilon_{it} \tag{11}$$

the permanent trust of fathers and mothers are measured with error. Results in Table 5 show that using lagged trust as an instrumental variable to correct for the resulting bias makes a major difference for the estimated coefficient of mothers, while it is nearly irrelevant for the estimated coefficient of fathers. This result might seem puzzling in light of the textbook notion that measurement errors on the explanatory variable imply an attenuation bias. To provide an explanation, we make use of an approximation to the OLS bias due to measurement error proposed by Theil (1961), who shows that when there are two regressors both affected by measurement errors the approximate OLS bias is:

$$bias(\beta_1) = -\frac{\beta_1\lambda_1}{1-\rho^2} + \frac{\beta_2\lambda_2\rho}{1-\rho^2} \tag{12}$$

$$bias(\beta_2) = -\frac{\beta_2\lambda_2}{1-\rho^2} + \frac{\beta_1\lambda_1\rho}{1-\rho^2} \tag{13}$$

where ρ is the correlation coefficient between the *true* regressors and $\lambda_j, j \in \{1,2\}$ is the ratio of the variance of the measurement error to the variance of the respective observable regressor (i.e., the sum of the variances of the measurement error and of the true regressor). If ρ were equal to zero, the bias would collapse to the standard attenuation bias. In this instance, the correlation between the two explanatory variables is large (ρ is 0.647 for the model without controls and 0.571 for the model with controls), hence the second component on the right-hand side of the equation has a positive sign, counterbalancing the standard attenuation bias, since both β_1 and β_2 are positive in our case. Deriving the values of λ_j and β_j from Tables 4 and 5 and plugging them in the equations (12) and (13), we obtain a bias for the coefficient of fathers of 0.173 and of 0.139 in the models without and with controls, while the biases for the coefficients of mothers are -0.351 and -0.313, respectively. This is in line with the difference we observe between the OLS and the IV estimates in Table 5, also taking into account sampling variability.

A2 Discreteness of observable trust as additional measurement error

To fix ideas, let us focus on the trust of fathers. We develop our analysis as if the observable trust takes values on a continuous scale. In reality, however, responses to the trust question are categorical, ranging between 1 to 4. A way to rationalize the problem is to think about the observable trust as a discretized version of a latent continuous score. That is, the respondent thinks about trust on a continuous scale, but the way the question is asked induces to round the score to the nearest integer in the range 1 to 4. In the following, we show that under mild conditions, the rounding generates an additional layer of measurement error. The straightforward implication is that the results of our analysis are unaffected, provided that the measurement error vf is redefined to include both the transient shock *and* the error due to rounding.

The key point to the validity of our analysis is that the measurement error must be uncorrelated to the permanent trust. Let Tf' be the unobserved continuous trust such that $Tf = rnd(Tf')$, i.e., the observable trust Tf is the rounded version of Tf'. Let vf' be the transient shock such that $Tf' = Tf^p + vf'$. The issue is then to derive sufficient conditions for having:

$$cov(rnd(Tf') - Tf^p, Tf^p) = cov(rnd(Tf^p + vf') - Tf^p, Tf^p) = 0. \tag{14}$$

Note that the last condition is equivalent to:

$$\frac{cov(rnd(Tf^p + vf'), Tf^p)}{var(Tf^p)} = 1, \tag{15}$$

i.e., the regression coefficient of $rnd(Tf^p + vf')$ on Tf^p should be equal to 1. For this to happen it is sufficient to prove that:

$$E(rnd(Tf^p + vf')|Tf^p) = Tf^p. \tag{16}$$

If the transient shock vf' is *symmetrically* distributed, the result follows straightforwardly since the discrete probability distribution resulting from rounding is symmetrically distributed around Tf^p. If vf' is not symmetrically distributed the result holds approximately. We performed some simulations using an heavily asymmetric distribution (a $\chi^2(2)$) obtaining essentially the same result as in the symmetric case.