



Inequality, perception biases and trust

Markus Knell¹ · Helmut Stix¹

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Abstract

This paper studies the effect of income (wealth) inequality on interpersonal trust. We propose a theoretical framework that links trust, trustworthiness and inequality. The key feature is that agents do not necessarily observe the entire income distribution but base their assessment on reference groups (i.e. they might hold a biased view of reality). In this framework the negative impact of inequality on interpersonal trust is related to the individual-specific perception of inequality. This has important implications for the empirical analyses since researchers typically do not observe perceptions but only objective measures of inequality (e.g. the Gini coefficient). We show that the use of the latter is appropriate only under restrictive assumptions and in general will result in an underestimation of the true effect. An unbiased estimate of the effect of inequality on trust can be obtained with a measure of individual-specific perceptions of inequality. Survey data support our framework. Perceptions of higher inequality exert a strong negative effect on trust.

Keywords Trust · Inequality · Perception

1 Introduction

Despite a substantial increase of interest in the multifaceted phenomenon of trust, there is still no consensus about the sources of trust. Some people see it primarily rooted in individuals' personalities (probably with a strong genetic base) while others explain it as the results of a history of bad or good experiences or point to the role of institutions and socio-economic conditions. One robust result of the empirical literature is that interpersonal

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✉ Markus Knell
Markus.Knell@oenb.at

Helmut Stix
Helmut.Stix@oenb.at

¹ OeNB, Economic Studies Division, Otto-Wagner-Platz 3, POB-61, A-1011 Vienna, Austria

trust is associated with social distance.¹ People from a similar socio-economic and socio-demographic background show more trusting behavior towards each other than people that differ along these dimensions.² Accordingly, one could conjecture that the increase in economic inequality over the recent decades might have had a detrimental effect on trust. Joseph Stiglitz, for example, has expressed his worries that “trust is becoming yet another casualty of our country’s staggering inequality. As the gap between Americans widens, the bonds that hold society together weaken” (Stiglitz 2013).

As it is widely uncontested that a high level of trust is of great importance for economic and social development (Zak and Knack 2001; Algan and Cahuc 2010; Daniele and Geys 2015), the paper studies whether rising economic inequality decreases interpersonal trust. We present a novel formal framework which conceptualizes the often vague notions of trust and trustworthiness and their relation to objective and perceived inequality. This allows us to state precisely under which conditions one can expect to find a close relation between trust measures and measures of economic inequality. The theoretical framework provides an important reference point for empirical estimations, i.e. to derive testable hypotheses and to organize our empirical analysis. It also helps to resolve conflicting results of the existing empirical literature. In particular, it offers an explanation why the effect of the Gini coefficient on trust is typically highly significant in cross-country analyses and often insignificant in within-country analyses. In a nutshell, the framework helps us to understand whether and how inequality might affect interpersonal trust and how the trust-inequality nexus can be identified empirically.

Our starting point is the trust question that is commonly used in the literature: “Generally speaking, would you say that most people can be trusted?” It has been widely discussed how survey respondents might interpret this rather general question and what might determine their answers. A common conjecture—frequently made in the related literature—is that trust is associated with (or almost synonymous to) “expected trustworthiness” and we adopt this argument.³ Respondents will say that other people can be trusted if they think that they behave in a trustworthy (i.e. cooperative, non-deceiving, non-opportunistic) manner. This, however, immediately raises two further questions. First, what determines trustworthiness and, second, what is the reference group that trusters (the survey respondents) have in mind when they answer a question about “most people”?

We stipulate that the trustworthiness of an arbitrary individual depends on personal traits (e.g. altruism), on socio-economic features (e.g. age, gender, employment status) and, importantly, on interpersonal differences for which economic inequality is the leading example. If the incomes of truster (Y_i) and trustee (Y_j) differ then this increases the likelihood that the trustee will not feel much common moral ground which decreases her willingness to cooperate. We assume that the strength of this feeling is related to the relative income difference $\nabla_{ji} = \frac{|Y_j - Y_i|}{2E^j(Y_x)}$, where $E^j(Y_x)$ is the trustee’s expectation of average income. The trust level of truster i will be influenced by his expectation about the income

¹Note that here and in the following quotation the meaning of “social distance” differs from the ubiquitous use of the word during the COVID-19 crisis.

²“In general, the more homogeneous a society, the more trust a (randomly selected) principal will place in a (randomly selected) agent” (Knack 2001, p. 7). “[A]nything that reduces the social distance between the citizens of a country could be expected to lead to more trust” (Bjørnskov 2007, p. 5).

³For example: “In defining trust I have spoken of one’s expectations regarding others’ choice of actions that have a bearing on one’s own choice of action” (Dasgupta 1988, 53). For more definitions see, e.g., Bauer (2019).

differences with all members j of his reference group, i.e. by $E^i(\nabla_{ji})$. The average trust level in a region will then be related to the mean of all individual perceptions of inequality ($E(E^i(\nabla_{ji}))$).

The first implication of the theoretical framework is that this mean of all individual perceptions of inequality corresponds exactly to the regional Gini coefficient under two crucial assumptions: (i) all individuals use identical reference groups when making income comparisons and (ii) these reference groups consist of all other persons from the own region but do not contain persons from other regions. The main specification of the empirical literature, regressing trust on Gini coefficients, can thus be rationalized within this conceptual framework if one believes that these “benchmark assumptions” are fulfilled.

We argue that these assumptions are highly unrealistic and that people typically have biased and heterogeneous reference groups. In particular, individuals tend to have closer and more frequent contact to people of a similar social and economic background and those similar people might be over-represented in respondents’ reference groups. Also, reference groups are not necessarily region-centered, e.g. some individuals will give a higher weight to people that live in their own region or neighborhood while other persons might think about people living in remoter places.

The assumption of biased and heterogeneous reference groups has a number of implications for empirical estimation. First, analytical results and numerical simulations show that point estimates obtained from regressing trust on the Gini coefficient are likely to understate the true trust-decreasing effect of inequality. Equally problematic, such regressions might often lead to an acceptance of the false null hypothesis that there is no effect of inequality on trust. The simulations show that this erroneous result is more probable if the variation of the Gini coefficient is rather small which is typically the case for analyses based on difference across regions within a country.

The second implication of the theoretical framework is that reliable estimates of the impact of inequality on trust can be obtained if one employs direct measures of individual perceptions of income inequality rather than objective measures like the Gini coefficient. This conclusion holds irrespective of the way how individuals form reference groups.

The third implication of the theoretical model concerns the individual perceptions of income inequality $E^i(\nabla_{ji})$. We show that these perceptions are U-shaped with respect to income. Individuals at the tail ends of the distribution see a larger extent of income inequality than individuals in the middle which follows from the assumption that individuals base their perceptions of inequality on expected pairwise income comparisons. This implication can be tested empirically and contrasted to different assumptions which imply a differently shaped relationship.

We utilize data from a survey that has been conducted among 2,000 Austrian residents to test the predictions of our framework. The survey elicits information on different aspects of trust and on various social issues, including the respondents’ subjective social standing and their perceptions of income inequality. Moreover, we have collected measures of income inequality for all 181 municipalities that are covered in our sample, derived from tax register data. This information is used to investigate the determinants of interpersonal trust and to study whether it is aggregate (“objective”) measures of inequality or individual-specific (“subjective”) perceptions of inequality that are more important for trust.

We find that the municipal Gini coefficients have no significant influence on individual trust. The same is true if one uses the 90/10 ratio as the inequality measure or alternative trust measures as the dependent variable. In line with the theoretical framework, however, subjective measures of the perception of inequality exert a strong adverse effect on trust.

Given the fact that both trust and inequality perceptions are personal attitudes it is difficult to pin down causality in a conclusive manner. In fact, one could argue that these attitudes are by nature formed in a simultaneous and interactive way which prevents the identification of a clear hierarchical causal structure. Nevertheless, we present additional evidence suggesting that there is in fact a direct influence of inequality perceptions on trust. First, we show that the effect remains almost unchanged if we focus on subsamples of similar individuals (e.g. in terms of optimism or institutional trust) for which arguably reverse causality should be less of an issue. Second, we find that for individuals who have never moved and who are therefore likely to have more locally composed reference groups the “objective” inequality measure does in fact exert a significant effect on trust as predicted by the model. An additional empirical result lends supports to the assumption that people perceive income inequality as the expectation of pairwise income differences. As predicted by the theoretical framework, we find that the relation between subjective perceptions of inequality and the rank in the income distribution is U-shaped.⁴

The paper builds upon the literature that studies the connection between (interpersonal and institutional) trust and socio-economic heterogeneity (including income inequality and ethnic fragmentation). Important papers in this wide literature are Knack (2001), Alesina and La Ferrara (2002), Uslaner (2002), Leigh (2006a, b), Bjørnskov (2007), Gustavsson and Jordahl (2008), Hooghe et al. (2009), Falk and Zehnder (2013) and the survey by Nannestad (2008). Our paper is also related to the literature that studies the perception of income and wealth inequality (Slemrod 2006; Norton and Ariely 2011; Kuziemko et al. 2015; Cruces et al. 2013; Gimpelson and Treisman 2018; Knell and Stix 2020) and the influence of biased perceptions on social attitudes (Clark and D’Ambrosio 2015). A closely related paper is Butler et al. (2016). While our model implies (under certain assumptions) a hump-shaped pattern of trust with respect to income, Butler et al. (2016) document a hump-shaped relation of income with respect to trust. Their explanation of this pattern is based on the argument that for individuals with too little or too much trust, income will be lower than for individuals that have an intermediate level of trust.⁵

Beyond providing a formal framework and estimation results, our paper helps reconciling conflicting findings of the empirical literature. Specifically, our findings suggest that the formation of reference groups might place a veil between objective measures of inequality and trust which calls for caution when interpreting respective empirical results. For example, the estimated impact of the Gini coefficient on trust is typically weaker (and less often significant) in empirical studies that are based on small and rather homogeneous cross-country data or on within-country data (Alesina and La Ferrara 2002; Gustavsson and Jordahl 2008; Leigh 2006b) than on large, rather heterogeneous cross-country data (Bjørnskov 2007; Hooghe et al. 2009; Leigh 2006a).⁶ Our model implies that these incongruent results reflect the fact that in cross-regional samples the variation in Gini coefficients is smaller and the likelihood of reference group heterogeneity higher than in cross-country samples.

⁴In a previous version of the paper we have also included another piece of evidence that highlights the importance of perception variables. In particular, we have shown that the perception of the ethnic intermix and the prevalence of crime in the own region are strongly related to individual trust, while this is not true for the corresponding objective measures. We leave a thorough discussion of these results for future work.

⁵We discuss the differences between these two approaches in Appendix B.3.

⁶For example: “The Gini coefficient, the measure used exclusively in previous studies, is more weakly related to Trust in our sample” (Gustavsson and Jordahl 2008, p.355), using a study based on Swedish regions. “Income inequality is among the most robust cross-country determinants of trust” (Bjørnskov 2007, p.5), referring to a sample of 64 heterogeneous countries.

The paper is structured as follows. In the next section we present our framework on the relation between inequality and trust and in Section 3 we focus on the role of reference groups. Section 4 studies the empirical relation between interpersonal trust and inequality and Section 5 concludes.

2 Theoretical framework

2.1 Trustworthiness

There are $i \in [0, N]$ individuals living in some geographical area. For the moment one can think of this area as a specific country. Later we will discuss the choice of the geographical unit in more detail.

Individuals differ along various dimensions including their personality traits, their ethnicity, their income, their employment status, etc. Each person has random encounters with strangers where the own payoff depends on the level of cooperation of the other person. In a prisoners' dilemma situation, e.g., the vis-à-vis might play "cooperate" or "defect", in a public goods situation the other might contribute to a common good or not and in a trust game the counterpart might return an investment or keep the advances for himself. The latter, sequential framework is the background of many experiments on the issue of trust (see e.g. Glaeser et al. 2000, Gächter et al. 2004) and we use it in the following to describe the trust situation. When individual i (the (male) truster) meets a randomly chosen individual j (the (female) trustee) he will face a specific level of cooperation (or "trustworthiness") TW_{ji} of the latter. This level of trustworthiness will depend on the personality traits of the trustee but also on how she sees the differences (in gender, socio-economic background variables, ethnicity etc.) between herself and individual i . We will primarily focus on economic differences. The related literature (see e.g. Bjørnskov 2007) emphasizes that cooperative, trustworthy behaviour increases in the degree of homogeneity between truster and trustee. Possible reasons for this phenomenon are, e.g., that a person feels more empathy for a similar other, that she can step more easily in the shoes of the other person or that her self-image will be damaged to a larger degree if she disappoints a kindred spirit by defective behaviour.⁷ These arguments are captured in the following expression:

$$TW_{ji} = \tilde{\alpha} + \tilde{\gamma} X_j - \tilde{\delta} \nabla_{ji}, \quad (1)$$

where $\tilde{\alpha}$ is a constant, X_j a column vector of person-specific variables (gender, age, education, personality characteristics, . . .) and $\tilde{\gamma}$ the corresponding row vector of coefficients. ∇_{ji} , on the other hand, measures the socio-economic difference between the truster i and the trustee j with $\tilde{\delta}$ the corresponding coefficient. In general the difference ∇_{ji} will be related to social differences in a broad sense that might depend on differences in income, wealth, status and human and social capital. In the following we will, however, often refer to the narrower concept of "income differences" since this corresponds to our empirical measures.

⁷The existing literature supports the relation between homophily and cooperativeness along various dimensions. It has been shown, e.g., that people are more cooperative towards anonymous strangers if they come from the same local area (Ruffle and Sosis 2006; Falk and Zehnder 2013) and also to people of the same nationality or race (Glaeser et al. 2000) or to people that share a facial resemblance (DeBruine 2002). It should be noted, however, that the results are not unambiguous and that, in particular, the connection is not confirmed for all dimensions of similarity. Buchan et al. (2008), e.g., find that each gender is just as trusting and trustworthy toward the own than toward the other gender. For an overlook on in-group favoritism in cooperation see Balliet et al. (2014).

In line with the psychological literature equation (1) assumes that person-related factors are not influenced by the specific social situation and therefore the vector X_j is independent of the identity of individual i . This, however, is not true for ∇_{ji} that captures the argument that “unfamiliarity breeds contempt” and “familiarity breeds sympathy”. According to this line of reasoning, individual j will show less cooperative or trustworthy behaviour if the other side of the random encounter is not considered to be part of the same moral community. We thus expect $\tilde{\delta} > 0$.

2.2 Perception of interpersonal inequality

There exist various possibilities to specify ∇_{ji} , i.e. how the trustee perceives the extent of interpersonal income differences. A straightforward specification is to assume that trustee j assesses the pairwise income heterogeneity as the absolute value of the relative difference between the two incomes Y_i and Y_j . In particular:

Assumption 1 (Absolute value of relative income difference)

$$\nabla_{ji} = \frac{|Y_i - Y_j|}{2E^j(Y_k)}, \quad (2)$$

where $E^j(Y_k)$ stands for individual i 's expectation of mean income in the region.⁸ Given that ∇_{ji} appears in interpersonal trustworthiness relation, the interpersonal inequality measure of relative income differences seems like a natural measure to use in this context. Below we will, however, also look at alternative specification. In the empirical section we will show that our data are consistent with Assumption 1.

After inserting Eq. 2 into Eq. 1 one can observe that we assume that the effect of income differences on trustworthiness is independent of the sign of $(Y_i - Y_j)$. In Appendix A.1 we discuss the case where the strength with which income differences affect trustworthy behavior depends on whether the other's income is higher or lower than the own income.⁹

2.3 Trust

When individual i is asked about his “general level of trust” he will think about a situation where he is in the role of the truster (e.g. by extending a favour, making an upfront

⁸Normally the absolute value of the relative income difference is defined as $\nabla_{ji} = \frac{|Y_i - Y_j|}{\bar{Y}}$ with \bar{Y} as the official measure of mean income in the region. We use $E^j(Y_k)$ in order to account for possible biases due to the existence of non-representative reference groups. We also multiply the traditional measure by one-half in order to receive more compact results below. This re-normalization has no substantive implications.

⁹In particular, we assume that this position-dependent effect can be written as $TW_{ji} = \tilde{\alpha} + \tilde{\gamma}X_j - \tilde{\delta}\varepsilon_{ji}\nabla_{ji}$ where $\varepsilon_{ji} = 2\varepsilon$ for $Y_j > Y_i$ and $\varepsilon_{ji} = 2(1 - \varepsilon)$ for $Y_j \leq Y_i$ and $0 \leq \varepsilon \leq 1$. The case with $\varepsilon = 1/2$ is thus the symmetric benchmark situation as shown in Eq. 1. In the following we will occasionally sketch how our results would change for the asymmetric case with $\varepsilon \neq 1/2$.

Note that the relative income difference (2) has also been proposed to measure the extent of relative deprivation (or relative satisfaction) and is frequently used in the literature on income comparisons, inequality and poverty (see Runciman 1966, Yitzhaki 1979, Hey and Lambert 1980, Clark and D'Ambrosio 2015).

In this context the perception of inequality $\frac{|Y_i - Y_j|}{E^j(Y_k)}$ has been argued to influence the feeling of (relative) deprivation experienced by the individual with income Y_j toward the individual with income $Y_i > Y_j$ (Hey and Lambert 1980, 567). In other words, in this context it has been argued that only (disadvantageous) upward income comparisons have an effect on relative deprivation which—using the above notation—would amount to the assumption $\varepsilon = 0$.

investment, lending money etc.). Under the assumption that individual i knows the determinants of trustworthiness (1) he has to form an opinion about the expected level of trustworthiness of a randomly chosen individual j . In other words, the level of trust of individual i (and thus his answer to the general trust question) will be related to his expectation of average trustworthiness $E^i(TW_{ji})$, where the expectations parameter $E^i = E(\cdot | \Omega^i)$ refers to the information set Ω^i of individual i that might not contain all available data. In particular, we assume that trust can be written as:

$$T_i = \check{\alpha} + \beta Z_i + \kappa E^i(TW_{ji}). \tag{3}$$

Interpersonal differences in trust can have various reasons. First, personal traits Z_i might again be important factors with associated coefficients β . Second, an individual might have biased perceptions of the world and might not refer to the universe of all individuals j when thinking about possible random encounters and the corresponding levels of trustworthiness TW_{ji} . Put differently, the information set Ω^i might only contain the incomes of all individuals $j \in \mathbb{S}_i$, where \mathbb{S}_i denotes the reference group of individual i . It is, e.g., quite likely that individuals from the own geographical region and the own social class are over-represented in this reference groups.

Using Eq. 1 in Eq. 3 one can then write:

$$T_i = \check{\alpha} + \beta Z_i + \kappa E^i \left(\tilde{\alpha} + \tilde{\gamma} X_j - \tilde{\delta} \nabla_{ji} \right) \tag{4}$$

or more compactly

$$T_i = \alpha + \beta Z_i + \gamma E^i(X_j) - \delta E^i(\nabla_{ji}), \tag{5}$$

where $\alpha \equiv \kappa \check{\alpha} + \check{\alpha}$, $\gamma \equiv \kappa \tilde{\gamma}$ and $\delta \equiv \kappa \tilde{\delta}$. Trust—the answer to the trust question—will thus depend on own person-specific factors Z_i of the truster i , on his expectations about person-specific factors $E^i(X_j)$ in his reference group and on $E^i(\nabla_{ji})$, i.e. individual i 's perception of income inequality conditional on his reference group.

We regard equation (5) as our benchmark specification to organize the empirical estimations and interpret the results.

2.4 Average trust

Equations 3 and 5 refer to the level of individual trust T_i in a specific region. The average (aggregate) trust level in this region is given by:

$$\bar{T} = E(T_i) = \check{\alpha} + \int_0^\infty \beta Z_i f(Y_i) dY_i + \kappa \int_0^\infty E^i(TW_{ji}) f(Y_i) dY_i, \tag{6}$$

where $f(Y_i)$ stands for the density function of incomes in the region with the corresponding distribution function $F(Y_i)$. Using Eq. 5, average trust thus depends on $E(E^i(\nabla_{ji}))$, i.e. the average value of all individual perceptions of inequality $E^i(\nabla_{ji})$.

2.5 Alternative specifications

Our benchmark model provides a framework that connects the notions of trustworthiness, trust and inequality in an intuitive and straightforward manner. It is based on three crucial assumptions: (i) trust is related to expected trustworthiness (3), (ii) trustworthiness is influenced by pairwise income differences ∇_{ji} (1) and (iii) these pairwise income differences are assessed by the relative income differences as specified in Eq. 2. These plausible assumptions are in line with the results of the related literature. In our empirical investigations we are not able to test for all of them in a direct manner, but we will provide evidence

that is in line with the assumption that individuals perceive income differences according to assumption 1.

It should be noted, however, that one could also disregard the entire framework and instead simply start with the assumption that trust is directly given by $T_i = \alpha + \beta Z_i + \gamma E^i(X) - \delta E^i(Q)$ where Q is some measure of income inequality. For this direct specification it is less straightforward to select the measure Q that individuals might use in their assessment of aggregate inequality. If they were using again interpersonal income differences as stated in Eq. 2 then the direct trust equation would read as:

$$T_i = \alpha + \beta Z_i + \gamma E^i(X_j) - \delta E^i(\nabla_{ji}), \tag{7}$$

which is of course completely identical to the reduced form trust equation (5) that comes out of our trustworthiness model. As an alternative specification one could now, however, also assume that individual use the more common Gini coefficient to assess the amount of aggregate inequality. In this case the direct trust equation would be given by:

$$T_i = \alpha + \beta Z_i + \gamma E^i(X_j) - \delta E^i(\mathbb{G}), \tag{8}$$

where \mathbb{G} stands for the Gini coefficient in the region. For these alternative specifications it is, however, less clear how the influence of inequality on trust might be explained or rationalized. As a basic argument one had to assume that this connection is related to unspecified environmental or psychological factors, e.g. to a general culture of distrust that is nourished in an unequal society. We will discuss below the different implications of specification (8) and our benchmark specification (5) and we will present evidence that supports the latter.

3 Reference groups

So far the general specification of trust allowed for an arbitrary formation of reference groups \mathbb{S}_i . Now we look at the implications of this conceptual framework under a set of specific assumptions concerning reference groups.

3.1 Benchmark reference groups

We start with the case where it is assumed that (i) all inhabitants of a region r have identical reference groups and (ii) this identical reference group consists of all inhabitants of region r and no member of a different region $r' \neq r$. We refer to this constellation of assumptions as “homogeneous, unbiased reference groups” or—for short—as “benchmark reference groups”.

3.1.1 Average trust

The following proposition refers to the average trust equation that results from the assumption of benchmark reference groups.

Proposition 1 *For benchmark (homogenous and unbiased) reference groups the average trust level \bar{T}_r in region r is the same regardless of whether individuals perceive inequality via pairwise income comparisons or via their estimate of the aggregate Gini coefficient. In particular, it is given by:*

$$\bar{T}_r = \alpha + \beta \bar{Z}_r + \gamma \bar{X}_r - \delta \mathbb{G}_r, \tag{9}$$

where \mathbb{G}_r stands for the Gini coefficient in region r .

Proof: For specification (8) the result follows directly. For the benchmark specification (5) the proof is also straightforward. In particular, note that the average weighted perception of inequality can be written as $\int_0^\infty E^i(\nabla_{ji})f(Y_i) dY_i = \int_0^\infty \int_0^\infty \frac{|Y_i - Y_j|}{2\bar{Y}} f(Y_j) f(Y_i) dY_j dY_i$. It is well-known (see Yitzhaki and Schechtman 2013) that this corresponds to the Gini-coefficient which can be defined as half the expected relative difference between two randomly drawn members from the population.¹⁰

Proposition 1 states the first central result of our paper. If reference groups are unbiased and the same for all individuals, then the average trust level in a region is determined by Eq. 9 and it does not matter whether individuals perceive inequality via pairwise income comparisons or via their estimate of the aggregate Gini coefficient.¹¹ If we look at one country then the country-specific Gini coefficient G_r has a negative effect on average trust and in a sample of countries one can obtain information on δ by regressing the average trust levels on the Gini coefficients. In fact, Eq. 9 corresponds to empirical estimations in cross-country regression (Leigh 2006a; Bjørnskov 2007) where average country-specific trust levels \bar{T}_r are regressed on country-specific Gini coefficients. The framework based on expected trustworthiness thus offers a straightforward justification for this popular empirical strategy.

3.1.2 Perception of average income inequality

Using the assumption of benchmark reference groups we can derive for each individual i the perception of average inequality based on pairwise income comparisons, i.e. $E^i(\nabla_{ji}) = \int_0^\infty \nabla_{ji} f(Y_j) dY_j$ (where we leave out the region indicator r).

Proposition 2 *For benchmark reference groups the extent of perceived average income inequality based on interpersonal comparisons (see Eq. 2) is given by:*

$$\begin{aligned}
 E^i(\nabla_{ji}) &= \frac{1}{2\bar{Y}} \left(\int_0^{Y_i} F(Y_j) dY_j + \int_{Y_i}^\infty (1 - F(Y_j)) dY_j \right) \quad (10) \\
 &\approx \eta_0 + \eta_1 \left(F(Y_i) - \frac{1}{2} \right)^2,
 \end{aligned}$$

where the approximation is around $F(Y_i) = 1/2$ and η_0 and η_1 are parameters stated in the Appendix.

Proof See Appendix A.1. □

Proposition 2 contains the second central result of our paper. If reference groups are unbiased and if individuals use ∇_{ji} to assess the extent of inequality then there exists a U-shaped pattern of the perception of inequality with respect to individuals' position in the income distribution. Income inequality is perceived as most severe for the lower and higher ends of the distribution with a minimum for $F(Y_i) = 1/2$, i.e. for the person with median income. As a consequence of this non-linear relationship one can thus conclude that

¹⁰In Appendix A.1 we show that Proposition 1 also holds for the case of an asymmetric impact of perceived inequality on trustworthiness as discussed in Section 2.2.

¹¹In Eq. 9 the vectors \bar{Z}_r and \bar{X}_r contain the region-specific averages of all variables that affect trust and trustworthiness, respectively. If a specific variable has an influence on both trust and trustworthiness (which is quite likely) then the regression will estimate the total effect of this variable.

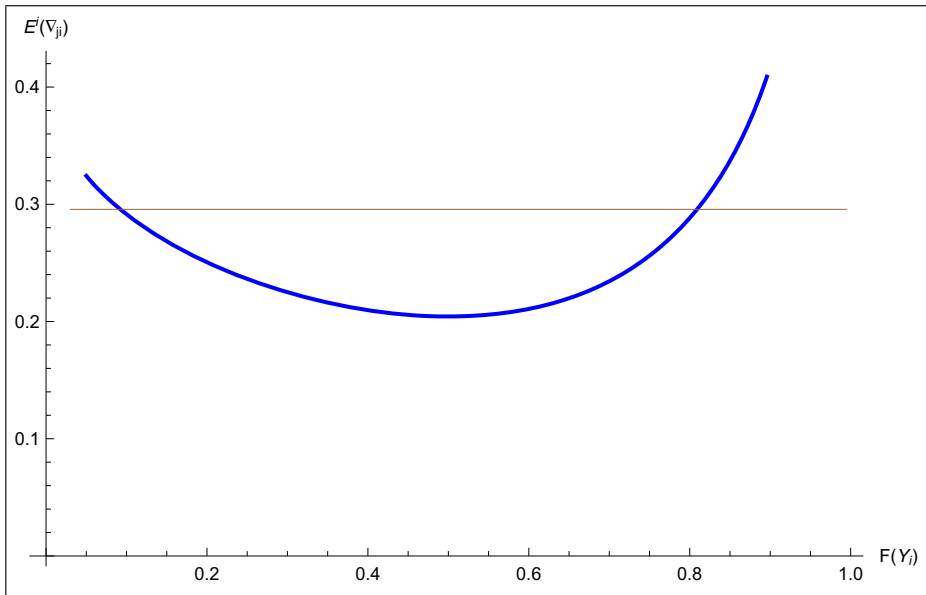


Fig. 1 The figure shows perceived inequality $E^i(\nabla_{ji})$ under the assumption that incomes are log-normally distributed with a mean income of 2,250, a standard deviation of 1,300 and an implied Gini coefficient of $\mathbb{G} = 0.3$ (shown as the flat line). This corresponds to the values in our survey data (for monthly household incomes)

empirical trust regressions should include higher-order (at least quadratic) terms of the true income rank.

Figure 1 illustrates the pattern of $E^i(\nabla_{ji})$ under the assumption of a log-normal income distribution. The U-shaped pattern of the perception of inequality is a consequence of the assumption that inequality is perceived as the expectation of pairwise income differences $E^i(\nabla_{ji})$. The precise shape of the curve as presented in Fig. 1 is, however, a consequence of the special underlying assumptions. We show below that for biased reference groups the trough will be observed for different (most likely higher) percentiles of the distribution.¹²

It is interesting to compare the pattern of $E^i(\nabla_{ji})$ to the results of the alternative assumption that trust is related to individuals' expectations of the Gini coefficient $E^i(\mathbb{G}_i)$ as contained in Eq. 8. In the case of benchmark reference groups each individual has an unbiased perception of the Gini coefficient ($E^i(\mathbb{G}_i) = \mathbb{G}$) and specification (8) implies identical perceptions of inequality for all individuals. This is shown by the flat line in Fig. 1 that corresponds to the Gini coefficient.

Finally, one can look at the implication of Proposition 2 for the trust equation (5). If individual income does not have a direct impact on trust via Z_i then the U-shape pattern of $E^i(\nabla_{ji})$ will translate into a hump-shape (an inverted U-shape) pattern of trust with respect to income. Trust, however, is also influenced by other personal characteristics Z_i that likely

¹²In Appendix A.1 we also illustrate the shape of trustworthiness-related perception of inequality $E^i(\varepsilon_{ji}\nabla_{ji})$ as it appears in the case when perceived inequality has an asymmetric effect on trustworthiness as discussed in Section 2.2. These curves are also U-shaped, but again with different patterns and different minima.

contain income Y_i . If the direct impact of income on trust is large then it will dominate the relation between the two variables and trust might be consistently increasing in income.¹³

3.2 Non-benchmark reference groups

The benchmark assumption of homogeneous and unbiased reference groups as made in Section 3.1 is highly restrictive. One would normally suspect that people have heterogeneous and biased reference groups that differ among each other both with respect to their “social” and to their “local” composition. First, people typically have closer contact with members of their own social group and these individuals will thus also get a larger weight when they form their expectations. Put differently, individuals do not know the correct distribution of income and they just draw “random samples” via their normal encounters with other individuals. The society, however, is stratified and so people meet predominately other people from their own or a similar income bracket. Second, the benchmark specification has assumed that the local radius of trust corresponds solely to the region of the truster. For cross-country studies this might be a reasonable assumption. For within-country studies, however, this can be doubted. In fact, the general trust question refers to “most people” and one would expect that many respondents will use a perception span that is wider than the own region.¹⁴

In order to study the implications of heterogeneous reference groups on our two important results—about average trust and the shape of individual inequality perceptions—one has to make specific assumptions. To do so in an appropriate manner one would ideally revert to empirical data on the formation of reference groups. Unfortunately, our data-set does not contain information on this issue and in general survey evidence on the composition of individual reference groups is still rather scarce (cf. Clark and D’Ambrosio 2015). Therefore we have used a number of stylized examples to illustrate the possible impact of biased perceptions on the results.

3.2.1 Average trust

In Appendix A.2 we use a number of simplifying assumptions about the income distribution and perception biases to derive analytical solutions of the average trust equation similar to Eq. 9 (for the benchmark case). We show that under the simplifying assumptions the benchmark trust (5) aggregates to:

$$\bar{T}_r = \alpha + \beta \bar{Z}_r + \gamma \bar{X}_r - \delta \phi(\cdot) \mathbb{G}_r, \quad (11)$$

where $0 \leq \phi(\cdot) \leq 1$ is a coefficient that depends on the size of the social or geographical perception bias.¹⁵ The larger the perception bias (i.e. the more reference group formation deviates from the benchmark assumption) the smaller the coefficient $\phi(\cdot)$. In this situation the regional Gini coefficient \mathbb{G}_r is not an appropriate measure for the perception of inequality. A regression of average trust levels on these regional Gini coefficients would result in a

¹³In the online Appendix B.3 we analyze the relation between income and trust in more detail and we discuss in particular the differences of our framework to the one by Butler et al. (2016) who focus on the reverse impact of trust on income.

¹⁴See Uslaner (2002) and Delhey et al. (2011).

¹⁵The coefficient on \bar{X}_r might also be biased depending on whether or not a specific trait X_i is correlated with income Y_i . We do not elaborate on this issue in the following since our focus is on the impact of inequality perceptions.

lower point estimate of the impact of inequality than the use of a direct measure of inequality perceptions $E^i(\nabla_{ji})$.

3.2.2 Perception of average income inequality

One can also use the stylized examples to study the impact of biased reference groups on the relation between income and inequality perceptions. We have shown above (see Eq. 10 and Fig. 1) that for the assumption of unbiased reference groups the individual perception of inequality $E^i(\nabla_{ji}) = E^i\left(\frac{|Y_i - Y_j|}{2E^j(Y_k)}\right)$ has a U-shape with a minimum for the individual with median income. For biased reference groups we get the same qualitative form even though the exact pattern of the curves and the location of the minima depend on how reference groups are formed.

In Fig. 2 we illustrate this issue for one specific assumption about reference groups. In particular, we assume that individuals have “limited perception spans” in the sense that an individual with income Y_i and a true income rank $F(Y_i)$ only observes people within the percentiles $Max(0, F(Y_i) - p)$ and $Min(1, F(Y_i) + p)$ where p is the perception span. This means that for $p = 1$ individuals observe the entire income distribution while for small p they will only see a narrow segment of the distribution (for details see the Supplementary Appendix C). In panel (a) of Fig. 2 we illustrate the pattern of the perception of inequality $E^i(\nabla_{ji})$ for three values of p (assuming again a log-normal income distribution). On the one hand, the perception of inequality is universally lower for smaller values of p . A large perception bias will thus induce people to underestimate the true extent of income inequality. On the other hand, the U-shaped pattern of the perception of inequality with respect to income is also present for socially biased reference groups. Low-income and high-income individuals perceive a larger degree of inequality than individuals with average incomes. In Appendix A.3 we also consider an alternative specification for biased reference groups. In particular, we assume there that individuals might have a bias towards upward or downward comparisons. We show that this assumptions also leads to a U-shaped pattern of perceived inequality where the trough of the curve is likely to be above the median income level.

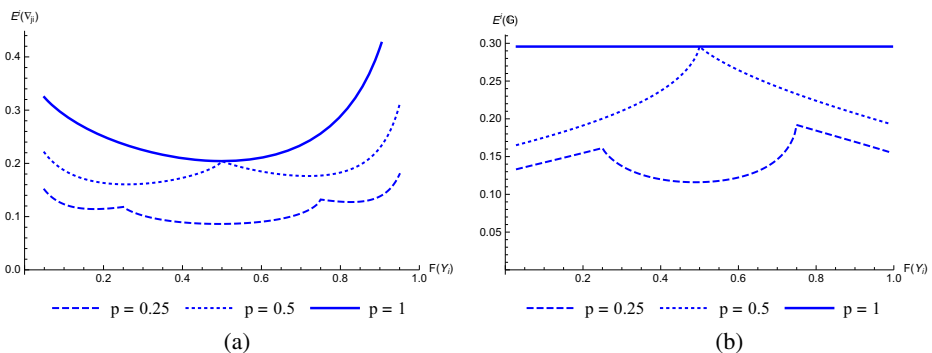


Fig. 2 Panel a shows perceived inequality $E^i(\nabla_{ji})$ based on the expectation of pairwise income differences. Reference groups are based on a limited perception span and we show three values of p . Panel b shows the case where the measure of perceived inequality is given by $E^i(G_i)$ as assumed in specification (8). In both cases it is assumed that incomes are log-normally distributed with a mean income of 2,250, a standard deviation of 1,300 and a Gini coefficient of $G = 0.3$

It is interesting to contrast the result for the assumption that individuals are using pairwise income comparisons to assess inequality with the one of specification (8) where individuals use a direct assessment of *aggregate* inequality $E^i(\mathbb{G}_i)$. The pattern of $E^i(\mathbb{G}_i)$ is shown in panel (b) of Fig. 2 for various assumptions about p . The patterns differ considerably from the ones that come out for $E^i(\nabla_{ji})$ as shown in panels (a). For the case of benchmark reference groups each individual would have the same perception of the Gini coefficient as is shown by the flat line for $p = 1$. For biased reference groups, on the other hand, the alternative measure implies a situation where the perception of inequality is smallest for individuals that are located at the tail ends of the distribution. This is the exact opposite pattern to the one that comes out by using our standard income comparison measure $E^i(\nabla_{ji})$. The difference matters if one is interested in the question of how inequality is perceived in different segments of society or who is likely to lose trust when the income distribution changes.

3.2.3 Heterogeneous reference groups

In Section 3.2 we have so far referred to biased but still homogeneous reference groups. For a discussion of heterogeneous reference groups one has to resort to simulations. In Appendix A.2.3 we report the results of various simulations that can be used to gauge the likely effect of heterogeneous reference groups on the size and the precision of the estimated coefficients of the Gini coefficient in empirical regressions. The results of the simulations (based on the model with “limited perception spans”) can be summarized as follows. First, empirical regressions that use the Gini coefficient will underestimate the true effect δ of inequality perceptions except if the assumption of benchmark reference groups is fulfilled. In particular, for larger perception biases and more heterogeneous reference groups the hypothesis that the estimated effect $\hat{\delta}$ equals the true effect δ is rejected for a large share of simulations. Second, and more importantly, in these cases of large heterogeneity the wrong hypothesis of no effect of inequality on trust cannot be rejected for a considerable share of simulations. Third, this erroneous inference is more likely if the sample size is small and if the cross-sectional variation in Gini coefficients is low. Both of these features (and especially the latter) are typical in cross-regional estimations. The presence of biased and heterogeneous reference groups thus offers an explanation for the fact that these kinds of empirical studies often fail to find a significant impact of inequality on trust when the perception of inequality is measured by the Gini coefficient. Finally, the simulations also show that the use of subjective perceptions of inequality in trust regressions will give rise to accurate estimations of the true effect δ of inequality on trust, irrespective of the sample size or the size of the cross-sectional variation of Gini coefficients.

4 Empirical results

In the following we empirically investigate the role of perceived inequality on trust by combining survey data from Austria with data on income inequality across Austrian municipalities. In the literature, the relation between interpersonal trust and inequality is typically tested in cross-country settings. According to the theoretical framework the relation should also be present across regions within a country, although the existing empirical evidence has been more mixed in these cases (Alesina and La Ferrara 2002; Gustavsson and Jordahl 2008; Leigh 2006b). This, however, makes within-country studies particularly interesting to analyse the interplay between trust, perceptions and inequality.

The survey has been conducted in 2011 among 2000 Austrian residents. Details on the data including variable descriptions and descriptive statistics are presented in Appendix B.1.

4.1 Trust and inequality

Our empirical specification is based on Eq. 5. The dependent variable is given by “trust in people”, a 0/1 variable derived from the “general trust question”: “Generally speaking, would you say that most people can be trusted—or you can’t be too careful in dealing with people?”. In the first step we follow the related literature and we use the Gini coefficient as the measure for the perception of inequality. In particular, we include the regional Gini-coefficient G_r as an explanatory variable which has been computed from tax register data on gross individual incomes at the level of 181 municipalities. The explanatory variables comprise a set of socio-demographic variables Z_i and municipality-level variables \bar{X}_r (average income, the number of inhabitants). The choice of respective variables is in line with the literature. *Objective rank* measures the rank in the income distribution, based on net monthly income of household recorded in 20 categories (where we use the mid-point of each category). The variable refers to the district-specific rank in the income distribution.¹⁶

All results are based on linear probability models.¹⁷ Table 1 summarizes the regression results for the inequality-related variables. The full table, shown in the Supplementary Appendix (Table B.2), reveals that results for household control variables are in line with respective findings from the literature, i.e., higher educated and well-informed individuals (the ones who read quality newspapers) have higher trust while unemployed, retirees and people with children as well as foreigners show less trust. The rank in the household income distribution is found to enter significantly. The implied pattern between trust and income is an inverted U-shape (with the peak at the seventh decile) and is thus in line with our theoretical framework’s prediction of a non-monotonic relation between income and trust.

Column 1 of Table 1 shows that the municipal Gini coefficient exerts no statistically significant effect on individual trust. This contradicts the implication of the framework presented in Section 3.1 where it has been assumed that individuals have socially and locally unbiased perceptions. Under this assumption the regional Gini coefficient should affect general trust.

Various explanations could be put forward for the statistical insignificance of the Gini coefficient. First, the empirical measure of the Gini coefficient might not capture the concept that individuals use to assess income inequality. Individuals might, e.g., refer to net instead of gross income, to household instead of individual units or to wealth instead of income. We do not have such alternative measures available at the municipal level. We do have, however, municipal data on the 90/10 ratio of the income distribution. Column (2) reveals that this alternative measure is also insignificant.

Second, some municipalities are rather small and respondents could look at a coarser geographical aggregation. We account for this by utilizing Gini coefficients for regions (a total of nine) and find that this has no effect (column 3).

Third, our trust measure might not adequately reflect the attitude of respondents. In columns (4) to (6) we use answers on a different trust question as the dependent variable: “How high is your trust in people in general?”. For this question, respondents could give

¹⁶In order to have enough observations per district, we utilize data from similar surveys from 2004 to 2011 (see Appendix B.1).

¹⁷The use of (ordered) probit models leads to very similar results (not shown).

Table 1 Trust and inequality

Dependent variable	Trust in people			Trust in people alternative def.		
				(0/1)	(4 cat.)	(4 cat.)
	(1)	(2)	(3)	(4)	(5)	(6)
Municipality Gini	-0.982 (1.271)	—	—	-2.059 (1.294)	-0.968 (0.674)	—
Municipality 90/10 inequality	—	-0.001 (0.031)	—	—	—	-0.005 (0.018)
Regional Gini	—	—	0.469 (2.217)	—	—	—
Objective rank	0.626*** (0.210)	0.623*** (0.211)	0.626*** (0.210)	0.468** (0.205)	0.229** (0.103)	0.227** (0.104)
Objective rank (squared)	-0.455** (0.203)	-0.454** (0.203)	-0.457** (0.202)	-0.256 (0.187)	-0.114 (0.092)	-0.113 (0.092)
Household controls	yes	yes	yes	yes	yes	yes
Municipality controls	yes	yes	yes	yes	yes	yes
Adj. R-squared	0.07	0.06	0.06	0.07	0.06	0.05
Observations	1272	1272	1272	1257	1257	1257

Dependent variables: In columns (1) to (3) the dependent variable is *trust in people*. In column (4) we use *trust in people alternative definition (0/1)*, in column (5) and (6) *trust in people alternative definition (4 cat.)*, i.e., the same variable recoded to 4 categories (0/0.33/0.66/1). All models report estimates from a linear probability model and include the following household control variables: Age and age squared, education, marital status, household size, children in household, labour market status (6 dummy variables with “private employee” as the base category), foreigner and quality news. All models include the following municipality control variables: Municipality avg. income (ln), Municipality population (ln). Since the objective rank is unavailable for many respondents estimations are based on 162 (instead of 181) municipalities. Standard errors in parentheses are adjusted for clustering at the municipality level. ***, **, * denote significance at the 0.01, 0.05 and 0.10-level. Variables are defined in Appendix B.1

four answers. In column (4) we have recoded responses to a binary variables and in column (5) and (6) we use all four categories. In neither specification does the regional Gini coefficient or the 90/10 ratio have a significant effect on trust.

Fourth, there might not be enough variation in the regional Gini coefficient. In fact, the data show that in 90% of the municipalities the Gini coefficient is between 0.31 and 0.40. Simulation results (see Section 3.2.3) suggest that a low cross-regional variance makes it more difficult to identify a significant effect regardless of whether perception biases are present or not. To analyze this issue, we artificially increase the standard deviation of Gini coefficients across municipalities by weighting observations with the squared distance between the municipality Gini and the Austria average which doubles the standard deviation of Gini coefficients (from 0.03 to 0.06). Column (1) of Table 2 shows that the Gini coefficient enters negatively and significantly in this artificial regression. This highlights one problem with cross-regional regressions.

A fifth explanation for the insignificance of the objective inequality measure in Table 1 is that people might not have homogeneous and unbiased perceptions of inequality as maintained in the benchmark assumption. The theoretical results and the simulation results indicate that the presence of heterogeneous perceptions renders it very likely that we

Table 2 Controlling for perception spans

Dependent variable	Trust in people		
	Weighted regression	Unweighted regression	Weighted regression
Municipality Gini	-3.827*** (1.261)	—	—
Munic. Gini x Not moved	—	-2.726** (1.294)	-5.881*** (1.612)
Munic. Gini x Moved	—	-0.167 (1.254)	-2.398** (1.151)
Not moved	—	0.922** (0.371)	1.294*** (0.432)
Household controls	yes	yes	yes
Adj. R-squared	0.27	0.10	0.28
Observations	1262	1262	1262

The dependent variable is *Trust in people*. In columns 1, the standard deviation of the Gini coefficients across municipalities is increased by weighting the regression with the squared distance of *Municipality Gini* from the Austrian average. In column 2, the effect of the Gini coefficient is separated between respondents that have moved and respondents that have not moved. Column 3 applies the specification of column 2 with the weighting scheme of column 1. The control variables are the same as in Table 1. Standard errors in parentheses are adjusted for clustering at the municipality level. ***, **, * denote significance at the 0.01, 0.05 and 0.10-level. Variables are defined in Appendix B.1

(erroneously) fail to reject the null hypothesis of no effect of inequality on trust. However, the effect should be identifiable if we could control for perception biases, for example if the regression is run only on individuals with a strong local perception span. Unfortunately, the survey does not contain direct information on individual (socially or geographically biased) reference groups. However, the survey provides information on where people grew up and whether they have moved. A reasonable proxy variable for regional perception spans can be constructed if we assume that individuals who have never moved (“Not moved”) have reference groups that are more local than individuals who have moved, after controlling for other confounding factors like media consumption and education. The theoretical model predicts that for individuals with a more local perception span the regional Gini coefficient should affect trust (see Eq. 20 of Appendix A.2.2). The results in column (2) of Table 2 are in line with this theoretical finding. The Gini coefficient significantly affects individuals who did not move whereas no effect is found for respondents who moved. The size of the coefficient can be evaluated by comparing the municipality with the lowest Gini coefficient (0.28) with the one with the highest Gini (0.52). A non-mover in the first municipality will be 66 percentage points $((0.52 - 0.28) \times 2.73)$ more likely to be trustful than a non-mover in the high-inequality municipality. This result is also apparent in column (3), where we repeat this exercise with an artificially weighted regression.

These attempts to control for local perception biases are in line with the theoretical framework but remain only indicative and rest on assumptions that cannot be tested due to the missing detailed information on individual reference groups. An alternative to accurately establish the effect of inequality on interpersonal trust is to use a direct measure of *perceptions* of inequality

4.2 Trust and the perception of inequality

To construct a measure for individual perceptions of inequality we use two survey questions. In particular, respondents have been asked about their assessment of how income and wealth are distributed in Austria: “What is your assessment about how income—the total sum of annual earnings—is distributed in Austria?” Answers comprise “extremely unequally distributed”, “very unequally distributed”, “rather unequally distributed” and “rather equally distributed” and we construct three dummy variables (the last two answers are collated into one category because of the low number of respondents answering “rather equally distributed”). A similar question was asked for wealth, making respondents aware that wealth comprises money, bonds, stocks, real estate and other assets.

Answers to these questions can be used to evaluate which of the assumptions about the perception of inequality is more in line with the empirical evidence. In particular, as we have discussed in Section 2 the pattern of the perception curve will depend on the underlying inequality measure and on the existence of biased reference groups (cf. Figs. 1 and 2). In our view the interpersonal measure ∇_{ji} seems the more natural choice since it offers individuals a straightforward way to come up with an assessment of the income distribution. In particular, respondents could simply form pairwise comparisons of their own income with all incomes they can think of (i.e. the incomes of the members of their reference group), then calculate the average of these numbers and finally relate the outcome to average income. This is exactly the measure $E^i(\nabla_{ji}) = \int_{j \in \mathbb{S}_i} \frac{|Y_j - Y_i|}{2E^i(Y_k)} f(Y_j) dY_j$ as used in Eq. 5.¹⁸

Proposition 2 stresses that $E^i(\nabla_{ji})$ should be U-shaped in the rank in the income distribution. Theoretically, we have shown that this pattern prevails both for homogenous and heterogeneous perceptions (Figs. 1 and 2a). The U-shape arises as people assess income inequality by building averages over pairwise income differences. In contrast, if they try to directly form an estimate of the Gini coefficient, one would expect a flat line in the case of homogenous perceptions or a hump-shaped pattern (see Fig. 2b).

In order to evaluate the validity of one or the other assumption it is therefore useful to investigate the pattern of perceived inequality depending on the rank in the distribution. Figure 3 reproduces Fig. 1 with our survey data. The left panel shows the average perceptions of inequality for each decile of the household income distribution of survey respondents (objective rank). Even though we observe only a small degree of variation between income deciles there nevertheless appears a (weak) U-shaped pattern. In fact, the pattern is quite similar to the theoretical shape that is obtained with a rather narrow perception span (i.e. a low value of p , see Fig. 2a).

The survey also elicits respondents’ self-assessed positions in society on a 10-step ladder (subjective rank). The right panel of Fig. 3 shows the average perceptions of inequality for each subjective rank. In this case, the U-shape is more pronounced. There are several arguments why we prefer the subjective rank over the objective rank. First, the subjective rank is likely to reflect a broader assessment of respondents wealth status whereas the objective rank refers only to reported household income. Second, the income variable refers to per period income and not to life-time income. This can be problematic for respondents with larger income fluctuations, like business owners. Also, it is not clear whether one should

¹⁸In order to translate the outcome into answer categories like “extremely” or “rather unequally distributed” respondents might fix the benchmark cases of complete equality (all individuals have the same income, $E^i(\nabla_{ji}) = 0$) and complete inequality (one person has the total income, $E^i(\nabla_{ji}) = 1/2$) and compare their actual assessment with these benchmark cases.

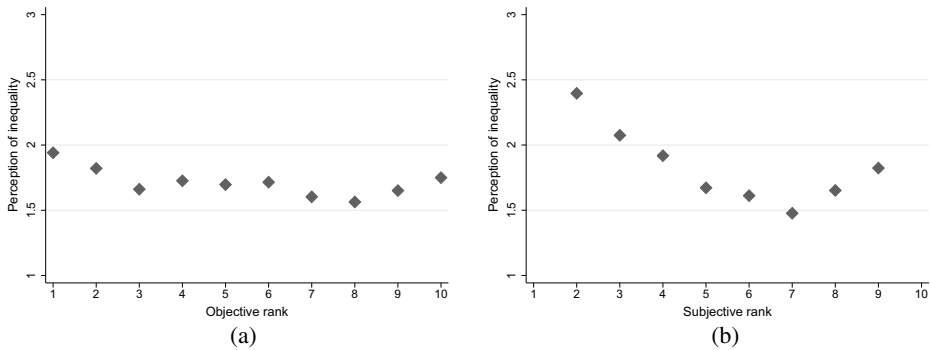


Fig. 3 The graphs shows the mean of the perception of inequality for a given objective rank (left panel) and subjective rank (right panel). The perception of inequality is coded as 1=“the income distribution is somewhat or rather unequal”, 2=“very unequal”, 3=“extremely unequal”. As the number of observations is very low for subjective ranks 1 and 10, we have aggregated them into rank 2 and 9 **a** Objective Rank vs. Inequality Perceptions **b** Subjective Rank vs. Inequality Perceptions

consider personal or household income. Finally, the income variable from the survey is top-coded which might conceal relevant variation.¹⁹

Regardless of which measure better reflects a survey respondent’s rank in society, it is interesting to observe that in both cases the perception of inequality is largest for low and high income individuals and that the U-shaped pattern is also confirmed in regressions that correct for other explanatory variables (see Appendix B.12). Summing up, the patterns shown in Fig. 3 correspond to the predictions of the model with pairwise income comparisons while they are not in line with the assumption that people form direct estimates of the Gini coefficient.

In line with these findings, we estimate equation (5) by including the subjective perceptions of income inequality as an additional explanatory variable. In all specifications of Table 3, these perceptions turn out to be highly significant and quantitatively important. The column (1) results show that the probability to trust decreases by 19 percentage points (10 pp.) for someone who sees incomes as extremely (very) unequally distributed while the objective inequality measure remains statistically insignificant. In the remaining columns of Table 3 we perform various robustness tests that leave this main conclusion qualitatively unaffected. In column (2), we replace the municipality Gini coefficients with municipality fixed effects which controls for unobserved variables at the municipal level. In column (3) we add a variable that captures the subjective assessment of the own financial situation which is found to be important for trust. In columns (4) and (5) we use the perception of wealth instead of income inequality. Column (6) employs the alternative trust measure as the dependent variable which results in qualitatively similar results.

4.3 Robustness tests

Overall, results are in line with theoretical predictions. In particular, controlling for regional perception spans (Table 2) shows that regional inequality is associated with trust. Although not a conclusive test we interpret this result as at least indicative for a causal effect of inequality on trust. First, we look at regions within one country that share a highly similar

¹⁹Using the perception of wealth inequality leads to almost identical figures.

Table 3 Trust and the perception of inequality

Dependent variable	Trust in people					Trust in people alternative def.
	(1)	(2)	(3)	(4)	(5)	(6)
Municipality Gini	-0.129 (0.989)	—	—	—	—	—
Income very unequal	-0.103*** (0.032)	-0.058* (0.032)	-0.050 (0.032)	—	—	-0.011 (0.025)
Income extremely unequal	-0.188*** (0.043)	-0.151*** (0.047)	-0.138*** (0.048)	—	—	-0.130*** (0.037)
Fin. sit. bad or very bad	—	—	-0.093*** (0.034)	—	-0.092*** (0.035)	-0.064** (0.026)
Wealth very unequal	—	—	—	-0.079** (0.032)	-0.069** (0.033)	—
Wealth extremely unequal	—	—	—	-0.159*** (0.049)	-0.148*** (0.050)	—
Subjective rank	0.718* (0.418)	0.910** (0.460)	0.783 (0.490)	0.943** (0.477)	0.814 (0.510)	0.367 (0.422)
Subjective rank (squared)	-0.245 (0.379)	-0.496 (0.405)	-0.449 (0.424)	-0.528 (0.422)	-0.477 (0.444)	-0.215 (0.356)
Household controls	yes	yes	yes	yes	yes	yes
Municipality controls	yes	—	—	—	—	—
Municipality fixed-effects	—	yes	yes	yes	yes	yes
Adj.R-squared	0.09	0.23	0.23	0.22	0.23	0.19
Observations	1847	1847	1822	1826	1805	1784

The dependent variable is *trust in people* in columns (1) to (5) and *trust in people alternative definition (4 cat.)* in column (6). All models include the same control variables as in Table 1. Standard errors in parentheses are adjusted for clustering at the municipality level. ***, **, * denote significance at the 0.01, 0.05 and 0.10-level. Variables are defined in Appendix B.1

institutional and legal environment. One can thus exclude that trust might have an effect on inequality via differential welfare state policies. Second, it is also implausible to argue that trust affects regional inequality through inter-regional mobility, given that we only look at people who did not move (which eliminates the effect of endogenous location decisions).

Admittedly, the causal interpretation is more difficult to maintain for the results involving the perception of inequality. While the results in Table 3 support the theoretical prediction that individual perceptions have more explanatory power for trust than the corresponding objective measure, we cannot conclusively state that this relation is causal. Basically, this boils down to the difficulty of identifying the direction of causality if a perception variable is regressed on another perception variable.

Notwithstanding these difficulties, in Table 4 we make an attempt to test whether the relation between the perception of inequality and trust might be driven by an unobserved third factor. It has, for example, been argued that trust is significantly influenced by a person's general "mood" and in particular by his or her outlook of the future (Uslaner 2002).²⁰ In column (1) of Table 4 we control for this sense of optimism by excluding individuals that indicate that they expect their economic situation in three years to be worse than today. For the sub-sample of optimistic individuals the impact of perceived inequality is similar than for the entire sample.

In columns (2) to (6) we focus on other sub-samples of individuals to control for potential confounding factors. We disregard individuals who state that they never do any voluntary work (column 2), individuals with below-median income (column 3) and those that indicate to have low trust in the judicial system (column 4). These three specifications exclude individuals with characteristics that are likely to reduce trust and that could also have an impact on reference group formation and perceptions. The effect of perceived inequality remains unaffected in the first two of these specifications.²¹ In the last specification, the effect of inequality perceptions is only weakly significant.²²

It might also be the case that the perception of inequality is influenced by the normative assessment of inequality. Put differently, individuals that show less acceptance for income inequality might evaluate the extent of inequality differently and might also show a systematically different trusting behaviour. In column (5) we disregard respondents who very much agree to the statement that the difference between poor and rich is too large in Austria.

It has been argued that trust is formed in early childhood and not much affected by day-to-day experiences (Uslaner 2002; Butler et al. 2016). According to this view trust is mainly inherited from earlier generations and will only adjust very slowly (if at all) to the socio-economic environment over time. Taking this argument to the extremes implies that trust will not depend on current inequality (unless the extent of inequality is itself very persistent across generations). A more moderate interpretation is that trust is not completely unalterable but that the updating occurs only slowly over the course of a lifetime. To check for this possibility, we split the sample by the median age in columns (6) and (7). The results indeed show that the effect of inequality perceptions is weaker for younger than for older respondents, indicating that the inherited component of trust plays some role.

²⁰“Trusting intentions reflect a basic sense of optimism and control. [...] A view that the future will be better than the past and the belief that we can control our environment so as to *make it better*” (Uslaner 2002, 112, 81). In contrast, optimistic individuals could also have specific reference groups and more dampened perceptions of income inequality.

²¹The variable for trust in the judicial system could also be used for a different purpose. In fact, our dataset contains about 10 measures for institutional trust (including trust in the courts, in government, in trade unions, in domestic and foreign bank). These measures could be used as dependent variables in a regression analysis to study their relation with measured or perceived inequality. Our framework would imply that perceived inequality is particularly important for *interpersonal* trust since it enters as a determinant of expected trustworthiness. The regressions (not shown) provide a mixed picture. The estimated coefficient of perceived inequality is insignificant for some measures of institutional trust (e.g. foreign banks) while of similar magnitude as in the general trust estimation for other measures (e.g. domestic banks or the police). This would suggest that perceived inequality is probably directly related to trust as assumed in Section 2.5. Alternatively, it is quite likely that institutional trust is also affected by interpersonal trust and inequality plays a role via this channel (see Hudson 2006). We do not have enough data to reach a definite conclusion on this issue and we leave it for future research. We are grateful to a referee for pointing out this issue.

²²Using the perception of wealth inequality (instead of that of income inequality), we find a strongly significant effect for this subsample of individuals.

Table 4 Unobserved heterogeneity: Different subsamples

Subsample	Trust in people						
	Optimism	Civic involvement	High income	Trust courts	Normative judgement	Age below median	Age above median
	(1)	(2)	(3)	(4)	(5)	(6)	(7)
Income very unequal	-0.069* (0.037)	-0.019 (0.053)	-0.038 (0.036)	-0.056 (0.037)	-0.059 (0.037)	-0.065 (0.049)	-0.046 (0.049)
Income extremely unequal	-0.141*** (0.053)	-0.131** (0.065)	-0.114** (0.055)	-0.087* (0.053)	-0.145** (0.061)	-0.082 (0.071)	-0.205*** (0.062)
Fin. sit. bad or very bad	-0.074** (0.036)	-0.055 (0.058)	-0.064 (0.045)	-0.132*** (0.040)	-0.086* (0.047)	-0.129** (0.051)	-0.059 (0.054)
Household controls	yes	yes	yes	yes	yes	yes	yes
Municipality fixed-effects	yes	yes	yes	yes	yes	yes	yes
Adj. R-squared	0.24	0.27	0.23	0.23	0.24	0.28	0.20
Observations	1492	847	1229	1084	1315	877	945

The dependent variable is *trust in people*. Column 1 disregards all respondents who expect their financial situation to worsen over the next 3 years. Column 2 disregards respondents who state that they never do any voluntary work. Column 3 disregards respondents with below median household income. Column 4 disregards respondents who do not trust the courts (i.e., the judicial system). Column 5 disregards respondents who very much agree to the statement that the difference between poor and rich is too large in Austria. Columns 6 and 7 focus on respondents with an age below and above the median age. All models report estimates from a linear probability model. Standard errors in parentheses are adjusted for clustering at the municipality level. ***, **, * denote significance at the 0.01, 0.05 and 0.10-level. Variables are defined in Appendix B.1

5 Conclusions

Results of this paper suggest that a perception of higher inequality is associated with lower interpersonal trust and that this conclusion holds regardless of whether objective measures of inequality, like the Gini coefficient, are found to exert a significant effect in empirical regressions.

We develop a formal framework which improves our understanding of the trust-inequality nexus and which helps to develop estimation strategies for identifying the effect of inequality on trust. In this framework trust is modeled as expected trustworthiness which in turn depends on expected relative income disparities among members of a society. We show that restrictive assumptions need to be fulfilled within this framework to warrant the common practice of regressing trust on the Gini coefficient: all individuals use identical reference groups when making income comparisons and these reference groups consist of all other inhabitants of a region and do not contain inhabitants of other regions.

We stipulate that these assumptions are unrealistic as individuals have heterogeneous as well as socially or geographically biased perceptions. Under these more realistic assumptions, it can be shown that the Gini coefficient is not an appropriate measure of perceived

inequality and that its use in empirical regressions of trust will yield point estimates that understate the effect of inequality. Equally problematic, such regressions are likely to fail to detect a significant effect of inequality at all. In simulations we quantify this effect of underestimation under stylized scenarios and demonstrate that one needs a considerable cross-regional (or cross-country) variation in inequality to detect a significant (albeit still biased) effect of inequality when using the Gini coefficient as the measure of perceived inequality.

These results rationalize the findings from the literature that regressions based on a wide range of countries typically show a rather large and significantly negative effect of the Gini coefficient on average trust, while more homogeneous cross-country samples or within-country studies often fail to find a significant relation between trust and the Gini coefficient. Some scholars have concluded from these results that the relation between inequality and trust is weak or non-existent. Our conceptual framework offers a straightforward explanation for this pattern of results and suggests that such a conclusion might be premature. Instead, our model shows that the effect of inequality can be estimated by an individual-specific measure of the perception of inequality. In addition, however, the model also suggests that trust and inequality might not move in locksteps. If individuals on average enlarge their reference groups (e.g. due to the influence of mass media) then average trust might change even if objective inequality stays constant. If, on the other hand, incomes get more unequally distributed but the society becomes at the same time more stratified with narrower reference groups it might well be that average trust stays the same despite the increase in inequality.

We test our framework with data from an Austrian survey. In line with the theoretical results, we find that regional Gini coefficients are related to trust only if we control for the perception bias while individual-specific measures of the perception of inequality exert a strong adverse effect. This result is robust to a number of different specifications and to employing different trust measures.

Our data did not allow us to answer all open questions in a conclusive manner and some of our results can only be regarded as indicative. This concerns in particular the direction of causality. We have presented some evidence (based on the analysis of subsamples and interaction effects) that are in line with the theoretical framework and point towards a causal relationship. For some regressions, however, causality is inherently difficult to establish because attitudinal variables appear both as dependent and independent variables. Future work should try to elicit further information concerning interpersonal trust, trustworthiness, perceptions and reference groups in order to corroborate and extend the findings. In particular, it would be desirable to collect data on how individuals form reference groups in order to provide direct evidence on the link between heterogeneous inequality perceptions and heterogeneous reference groups. The availability of detailed information about these issues would help to further disentangle the causal interdependencies and mutual influences between trust, income and inequality.

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