Trust and CO_2 Emissions: Cooperation on a Global Scale*

Ara Jo Stefano Carattini

July 28, 2021

Abstract

Although the effect of trust on local cooperation is well-documented, little is known about how trust influences global cooperation. Building on a large body of theoretical and experimental literature, we hypothesize that trust shared in a society may positively affect global cooperative behavior. We provide empirical evidence in the context of climate change that an increase in trust is associated with a larger reduction in CO_2 emissions across countries, controlling for country fixed effects and a number of time-varying factors. As a falsification test, we estimate the relationship on an earlier period when there was no concern of man-made climate change (before the 1980s) and find no impact of trust on CO_2 emissions during that period.

Keywords: Trust, cooperation, climate change.
JEL Classification: Q54, N50, Z10.

*Jo: Center of Economic Research, ETH Zürich, Zürichbergstrasse 18, 8089 Zürich, Switzerland. Email: ajo@ethz.ch. Carattini: Department of Economics, Andrew Young School of Policy Studies, Georgia State University, 14 Marietta, Atlanta, GA 30303, USA, Grantham Research Institute, London School of Economics, CESifo and the University of St. Gallen. Email: scarattini@gsu.edu. We thank two anonymous referees, Elizabeth Baldwin, Tim Besley, Ulrich Berger, Marco Casari, Antoine Dechezleprêtre, Roger Fouquet, Steve Gibbons, Karlygash Kuralbayeva, Antony Millner, Francesco Nava, David Rand, Olmo Silva, Thomas Sterner, Alessandro Tavoni, Ulrich Wagner and participants in various seminars and conferences for their helpful comments. All errors are our own. Carattini acknowledges support from the Swiss National Science Foundation, grant number P2SKP1_16502.

1 Introduction

There seems to be a broad consensus that trust facilitates cooperative behavior where incomplete contracts and imperfect information plague an organizational group (Algan and Cahuc, 2013). However, what remains unanswered is to what extent, if at all, intragroup trust affects intergroup cooperation. In this article, we ask how trust shared between individuals facilitates local cooperation, and in turn, influences *global* cooperation. We empirically investigate this research question in the context of one of the most complex challenges facing the world today: climate change.

Our conceptual framework hypothesizes that trust shared in a society may positively affect global cooperation. As motivating evidence, Figure 1 depicts a cross-country correlation between the Climate Laws, Institutions, and Measures (CLIM) Index that measures the stringency of climate change legislation across countries and a measure of trust from the World Value Survey (WVS).[1] It is readily observable that countries with high levels of trust tend to implement more stringent climate policies, thus contributing more to the mitigation of climate change. The correlation is statistically significant at the 5 percent level. A similar pattern is observed within Europe. There exists a strong positive correlation between trust and the voluntarily determined, legally binding target share of renewable energy in gross final energy consumption by 2020 across European countries (Figure A1).[2] The correlation remains statistically significant even when we control for GDP per capita, population, and the share of the population with secondary education.

To subject these observations to more rigorous econometric analysis, we investigate the relationship between trust and global cooperation measured by the reduction in CO_2 emissions across countries. For identification, we adapt the methodology developed in Algan and Cahuc (2010), which successfully deals with typical challenges involved in estimating the effect of trust such as how to deal with time-invariant un-

[1]The index is an internationally comparative measure of climate change policies and measures developed by the European Bank of Reconstruction and Development (EBRD, 2011). The WVS measures generalized trust by asking the standard question, "Generally speaking, would you say that most people can be trusted, or that you can't be too careful in dealing with people?" Respondents are provided with a binary choice between 0 and 1 where 0 implies "You can't be too careful" and 1 means "Most people can be trusted." We pool data from six waves (1984, 1993, 1999, 2004, 2009, and 2014) and construct a country-level trust variable by calculating the average of this answer within each country.

[2]These targets, which are part of the National Renewable Energy Action Plan, are voluntarily chosen to contribute to the EU-wide goal of achieving a 20 percent target share of renewable energy in gross consumption by 2020 under the Renewable Energy Directive (2009/28/EC).

observable national characteristics. A quick solution would be to include country fixed effects. However, it is not straightforward to do so due to the documented persistence of trust and the absence of long panel data. In this context, the key intuition behind this methodology is to infer time variation over long periods by focusing on the inherited component of trust. Based on the persistence of trust across generations (Rice and Feldman, 1997; Putnam, 2000; Guiso et al., 2009), Algan and Cahuc (2010) estimate trust held by previous generations by observing the trust levels of US immigrants who inherited this from their ancestors who traveled to America from different countries at different points in time. Time variation in inherited trust thus comes from the ancestors' time of arrival in America, under the assumption that the prevailing social norms and attitudes from their home countries were brought with them and passed on to their descendants. A time-varying measure of inherited trust obtained by such logic provides credible information on the level of trust held by previous generations and country fixed effects can be included.

This methodology also attempts to reduce the concern of time-varying omitted variable bias by imposing a lag of a minimum of 25 years (one generation) between the time when trust was transferred (that is, the ancestor's time of arrival in America) and the current level of CO_2 emissions in the ancestor's home country. This makes it less likely that the level of emissions and the level of trust held by those who left their home country at least 25 years prior were driven by the same unobservable factors simultaneously. Following Algan and Cahuc (2010), we also impose a longer lag of 50 years between these two variables as a robustness check. We further control for several changes in the economic, political, cultural, and social environment to mitigate this bias.

Our findings suggest that an increase in inherited trust is a statistically significant factor that explains the reduction of CO_2 emissions between 1950 and 2010, even when we include country fixed effects and control for several time-varying factors. The methodology requires that we have a long period that allows for sufficient time variation in trust. However, in our case, going far back in time comes at the cost of including an era when there was little awareness of man-made climate change. Being mindful of this limitation, we run a falsification test on the period between 1920 and 1980 when there was no reason to expect the relationship between trust and CO_2 emissions to exist. What we find is exactly that; between 1920 and 1980, there is no observable link between trust and CO_2 emissions, while we see a strong positive relationship between

trust and economic growth, which is not contingent on any specific period.

Next, we carefully discuss two alternative interpretations of our results. First, one might argue that high-trust countries are more effective in local pollution abatement efforts, which could have led to concurrent reductions in CO_2 due to spillover effects or complementarity between local and global pollutants. However, existing studies provide evidence against such global spillover effects of local pollution regulations (Holland, 2012; Brunel and Johnson, 2019). Another alternative interpretation is that high-trust countries might have reduced more CO_2 emissions than low-trust countries because they experience larger local benefits from climate change mitigation. We check this possibility by looking at the predicted damage from climate change at the country level. Again, we find a negative correlation between the degree of vulnerability to climate change and inherited trust in 2010 across countries, which is not consistent with this alternative interpretation.[3] Therefore, we remain in favor of our interpretation that the relationship between inherited trust and CO_2 emissions signifies a higher willingness to engage in global cooperation in high-trust societies.

We then discuss the potential mechanisms underlying our results in light of our conceptual framework. First, there exists substantial evidence that interpersonal trust is positively correlated with climate-friendly behavior at the individual level (Carattini et al., 2019). Then, we provide empirical observations that individuals' climate-friendly preferences and behavior tend to translate to formal climate legislation at the country level (Gifford and Nilsson, 2014; Alló and Loureiro, 2014). Finally, the observed cross-country correlation between trust and the adoption of climate change legislation is strengthened by theoretical explanations in the literature on international environmental agreements that emphasize trust and reciprocity of state actors (e.g., Nyborg, 2018). We believe our empirical findings on the role of trust in reducing CO_2 emissions are strongly supported by the individual- and institutional-level observations.

Our paper adds to the well-established literature on the effects of trust, or social capital at large, on various economic outcomes. Trust has been shown to affect economic development (Knack and Keefer, 1997; La Porta et al., 1997; Zak, 2001; Tabellini, 2010; Algan and Cahuc, 2010), financial development (Guiso et al., 2004), trade patterns (Guiso et al., 2009), the design of institutions and regulations (Algan and Cahuc, 2009; Aghion et al., 2010, 2011) and the compliance decisions of companies (Jo, 2021).

[3]To measure vulnerability to climate change, we use the Vulnerability Index, which is part of the University of Notre Dame Global Adaptation Index. This index measures a country's exposure, sensitivity, and capacity to adapt to the negative effects of climate change in Figure 3.

Adding to this literature, we provide novel findings that trust shared among individuals could influence the pattern of global cooperation in the context of climate change.

Also related is a large body of literature that analyzes the determinants of greenhouse gas emissions. Following early studies by Grossman and Krueger (1991, 1995) and Antweiler et al. (2001), several papers have examined the relationship between economic growth and greenhouse gas emissions, with a specific focus on technological change, industrial composition, and trade (Azomahou et al., 2006; Levinson, 2009; Copeland and Taylor, 2005). More broadly on climate policies, researchers have studied various factors that affect the stringency of climate measures across countries such as climate change perception, environmental values, and risk attitudes (see Drews and Van den Bergh, 2016, for a review of the literature) as well as the role of political trust and other local social norms in supporting climate action (Rafaty, 2018; Klenert et al., 2018; Carattini et al., 2018, 2019). We contribute to this literature by providing empirical evidence that interpersonal trust shared within a country could also have a non-negligible impact on the level of CO_2 emissions.

The paper is organized as follows. In Section 2, we discuss the relevant theoretical and experimental literature that gives rise to our hypothesis. Then, we discuss the data in Section 3. Section 4 presents the estimation strategy and findings. Section 5 provides a discussion of alternative interpretations and potential mechanisms underlying our results. Section 6 concludes the paper.

2 Conceptual Framework

There exists a broad consensus that trust facilitates cooperative behavior where incomplete contracts and imperfect information plague an organizational group (see Algan and Cahuc, 2013, for a review). In repeated games with a random matching set-up, for example, Okuno-Fujiwara and Postlewaite (1995) and Kandori (1992) show that there exists a cooperative social norm between trustworthy players —trustworthy in the sense that it is expected for them to follow the norm rather than violate it —which can be sustained in a large community when players are sufficiently patient. Importantly, the probability of successful cooperation increases as the share of trustworthy players rises in the population. Trustworthy players have a greater incentive to not defect against other players and preserve their reputation when they know that other trustworthy players exist in the population and will cooperate with them in the fu-

ture. This theoretical finding resonates well with the empirically documented effect of trust and reputation on sustaining cooperation in the context of natural resources management (Ostrom, 2000; Milinski et al., 2002; Poteete et al., 2010).

There is a growing body of experimental evidence that extends this insight to a global scale. For example, Jordan et al. (2016) provides evidence that one's concerns about their reputation drive uncalculating pro-social cooperation. They introduce a novel two-stage incentivized economic game where in the first stage, player A decides whether to help a recipient and pay them a fee in either a calculating or uncalculating way and in the second stage, player B (who is not involved in the first stage) and player A play a trust game, where player B is the truster and player A is the trustee.[4] In standard trust games, the amount sent by player B to player A reflects B's trust of A and the amount returned from A to B reflects A's trustworthiness. Results first suggest that player A is more likely to be uncalculating when the decision-making process in the first stage is observable to player B than when the process is hidden, indicating that people tend to use uncalculating cooperation to benefit their reputation. Additionally, findings show that uncalculating cooperation is indeed perceived as a sign of trustworthiness, as player B tended to send more money when they observed that player A was uncalculating in the first stage. This evidence seems to directly support our hypothesis that trust and the incentive to be seen as trustworthy play a key role in global cooperative behavior (which is analogous in spirit to player A helping a recipient in the first stage who they will not meet in the second stage).

Similarly, Milinski et al. (2006) conducts an experiment where players were first asked to contribute to a "climate fund" that would benefit the entire world and then play a 2-player prisoner's dilemma (PD). The authors find that players were much more willing to contribute to the climate fund when the information on each player's contribution was going to be shared in the next round of the PD than when each contribution remained anonymous.[5]

[4]The authors employ two approaches to operationalize uncalculating versus calculating decision-making. One is to provide player A with the choice of looking at the cost of helping the recipient before choosing to help. Another approach is to measure the time player A spends before deciding to help when the cost is revealed. This is based on experimental evidence that quick cooperative choices are perceived to be more pro-social.

[5]In a more generic setting, Milinski et al. (2002) also found that a higher level of cooperation is sustained in public goods games (PGGs, which represent a global setting) when they are alternated with 2-player PDs (which represent a local setting) than when all PGGs are played first and followed by a series of PDs. This reflects how when players do not contribute in the PGG, it harms their reputation in the following PD. This induces players to contribute in the PGGs.

Recent work by Hauser et al. (2016) provides further evidence on the interaction between local and global cooperation through the concept of reputation. In alternating rounds of public goods games (PGGs) and PDs, they find that in a pairwise PD with two neighbors, players were more likely to cooperate with neighbors who had contributed at least as much as they did in the preceding PGG as well as with neighbors who had cooperated with them in the previous PD. That is, participants reciprocated not only their neighbor's previous pairwise cooperation but also their contributions in the PGG, which the authors call local-to-global reciprocity.[6] They also show that when both neighbors defected in the PD, the player significantly increases contribution in the following PGG, which provides direct evidence that local punishment effectively induces global cooperation.

These findings motivate our hypothesis that trust shared in a society may positively affect global cooperative behavior. In the remaining part of the paper, we aim to empirically test the relationship between the level of trust and the degree of global cooperation across societies.

3 Data Description

We measure the willingness to engage in climate change mitigating global cooperation via the reduction in CO_2 emissions.[7] This choice is guided by the existing literature where it is standard to frame reductions in CO_2 emissions as the degree of cooperativeness in global public goods problems (e.g., Milinski et al., 2008; Tavoni et al., 2011; Brick and Visser, 2015). Alternatively, the stringency of climate legislation used in Figure 1 or the participation of a country in international agreements such as the Kyoto Protocol could offer more direct measures for the willingness to engage in global cooperation. However, these measures have no time variation, limiting the nature of the analysis to be cross-sectional. Further, in the case of the Kyoto Protocol, the European Union signed the treaty jointly, which leaves little cross-country variation in our sample that includes many European countries (20 out of 26 countries in our sample).

For data on CO_2 emissions, we rely on the Carbon Dioxide Information Analysis

[6]Here, the group sizes in PGGs are much bigger than usual with 39 players on average. In a second experiment, they replicate their findings with a group of 1,000 players for the PGGs and provide further evidence on the scalability of local-to-global reciprocity.

[7]As described in the next section, the dependent variable is log CO_2 emissions per capita. However, there are two periods that include country fixed effects in all specifications, thus always relating the *change* in emissions to the *change* in the level of trust.

Center (CDIAC) that provides historical emissions data measured in thousand metric tons of carbon dioxide. The emissions estimates are derived from energy statistics published by the United Nations. Data on population and economic growth measured by income per capita in 1990 US dollars come from the Maddison database (Bolt and Van Zanden, 2014), which covers the period 1820 - 2010.[8]

To trace the evolution of trust in different countries, we use information from the General Social Survey (GSS) measuring the trust levels of US immigrants and their ancestors' country of origin, provided since 1978. Individual trust is measured by the following question commonly used in other surveys and the relevant literature: "Generally speaking, would you say that most people can be trusted or that you need to be very careful in dealing with people?" Respondents answer the question by choosing one of the following options, "Most people can be trusted," "Can't be too careful," and "Depends." We construct a binary trust variable that takes 1 if the respondent answered that most people can be trusted and 0 if otherwise. The fraction of respondents who answered "Depends" is small (around 4 percent) and thus the categorization has little influence on the results of our analysis. We report the results from various alternative specifications of the trust measure in section A2 in the Appendix.

Respondents were able to identify up to three countries for their ancestors' origins in order of preference and when more than one country was named, respondents were asked to specify one country to which they felt closest. We use this information to construct the country of origin variable following Algan and Cahuc (2010). Our baseline sample includes 26 countries including most European countries: Austria, Belgium, Canada, Czech Republic, Denmark, Finland, France, Germany, Greece, Hungary, India, Ireland, Italy, Japan, Mexico, Netherlands, Norway, Poland, Portugal, Russia, Spain, Sweden, Switzerland, United Kingdom, former Yugoslavia, and African origins as a single category. We only include countries of origin with 10 or more observations in our estimations (Table A1).

We use information on the birth year of the respondents and which immigrant generation they belong to in order to estimate their ancestors' time of arrival in America. Respondents were asked if they were born in the United States and how many of their parents and grandparents were as well. Based on this information, we distinguish four generations of US immigrants: first-generation Americans, second-generation Americans with at least one parent born abroad, third-generation Americans with both

[8]Section OA1 in the Supplementary Online Appendix provides more detailed data descriptions.

parents born in the United States and at least two grandparents born abroad, and fourth-generation Americans with both parents and more than two grandparents born in the United States.

Current trust in the home countries, which is intended to compare with the estimated inherited trust from US immigrants, comes from the European Social Survey (ESS) for European countries and the World Value Survey (WVS) for non-European countries. The trust question in both surveys is the same as the GSS, which makes the variable comparable across the databases.[9] Whenever possible, we use the 2010 wave of both surveys to provide a comparison with trust transmitted in 2010 estimated from the GSS. We rely on the 2005 wave of the WVS for Canada.

4 Empirical Analysis

4.1 Estimating the Role of Trust in Reducing CO_2 Emissions

Our aim is to estimate the effect of trust on global cooperation measured by the reduction in CO_2 emissions. To this end, we run the following regression:

$$Emissions_{ct} = \alpha_0 + \alpha_1 T_{ct} + \alpha_2 X_{ct} + F_c + F_t + \epsilon_{ct} \tag{1}$$

where $Emissions_{ct}$ is log per capita CO_2 emissions in country c and time t. T_{ct} measures the average trust of individuals who live in the country c and time t. X_{ct} includes a vector of time-varying country characteristics that influence the level of emissions such as the size and structural composition of their economies and openness to trade. F_c denotes country fixed effects that control for unobservable time-invariant national features such as geography, fossil fuel endowments, and potential damage from changing climate, as well as initial economic development or historical institutional qualities that may have had an influence on trust and characteristics of the economy. Finally, F_t

[9] Although the wording of the questions is identical, the scale given for the answer differs across these surveys. GSS offers three options, "Most people can be trusted," "Can't be too careful," and "Depends," while the ESS offers a scale from 0 to 10 (with 10 being the highest level of trust) and the WVS offers only two options, "Most people can be trusted" and "Can't be too careful." The construction of a binary trust variable from the GSS allows a straightforward comparison with the answer from the trust question in WVS and the categorization has little impact on the comparability of the two variables. This is because as stated in the main text, the fraction of respondents who choose "Depends" was minimal. For the ESS, we also construct a binary variable that takes 1 if the respondent chose a number larger than 5 and 0 if otherwise.

denotes period fixed effects common to all countries.

The task of uncovering the causal effect of trust is not straightforward. First, given the substantial evidence that trust tends to be highly persistent across generations (Rice and Feldman, 1997; Putnam, 2000; Guiso et al., 2006; Nunn and Wantchekon, 2011), we need a measure for trust with intertemporal variations over several generations. However, the cross-country measure for trust available from the World Value Survey only goes back to the late 1980s, which does not allow sufficient time for trust attitudes in individuals to evolve. Second, the correlation between changes in trust and changes in CO_2 emissions in a model with country fixed effects can be interpreted as causal only if these two variables are not simultaneously affected by common time-varying factors. For example, one can imagine that political or social events in a country that potentially affected generalized trust or trustworthiness of the population could occur at the same time as industrial activities that led to changes in CO_2 emissions.

To overcome these difficulties, we follow the methodology developed by Algan and Cahuc (2010). The authors provide a way to estimate the causal effect of trust on economic growth by focusing on the inherited component of trust and its time variation over long periods. The key insight here is that due to the persistence of trust, parents' trust is a strong predictor of their children's trust. Based on this observation, they trace the evolution of inherited trust from that of US immigrants who inherited it from their ancestors who immigrated to America from different countries at different points in time. Time variation in inherited trust thus comes from the ancestors' time of arrival in America, under the assumption that they brought with them the prevailing social norms and attitudes from their home countries. Inherited trust is measured by the country-of-origin fixed effects in individual regressions of the current trust of the descendants of US immigrants. The coefficients of the country-of-origin fixed effects, which we denote as $\hat{T}_{ct}$, serve as a proxy variable for trust by replacing T_{ct} in equation (1). The coefficient of the inherited trust variable α_1 then reflects the correlation between inherited trust and contemporaneous CO_2 emissions.

This method also attempts to mitigate time-varying omitted variable bias by imposing a lag of one generation (defined as 25 years) between the time of immigrant ancestors' arrival in the US and contemporaneous CO_2 emissions in the ancestors' home country.[10] It is then less likely that some unobservable factors are simultaneously driving the level of emissions in 2010 and the social norms and attitudes that

[10]The lag structure effectively replaces $\hat{T}_{ct}$ with $\hat{T}_{c,t-25}$.

have prevailed from at least one generation ago (with which immigrants arrived in the US). We also try a longer lag of two generations (50 years) between these two variables as a robustness check. The implementation of this strategy is explained in detail in the following section.

The need to go back far enough in time to allow sufficient time for inherited trust to evolve (which is at least a couple of generations) and data availability lead us to consider the period between 1950 and 2010 in our baseline estimation.[11] However, we are also aware that until the 1980s, there was no awareness of man-made climate change and therefore there is no conceptual link between trust and cooperation in climate change mitigation efforts.[12] We make a trade-off between going as far back as 1950 and including an era when there was no prior awareness of the relationship between trust and CO_2 emissions. Later, we run a falsification test on the period between 1920 and 1980 in which we do not expect to observe a link between trust and emissions. As a robustness check, we also consider an alternative period (between 1970 and 2010) and find similar results as the main analysis.

4.2 Inherited Trust of US Immigrants and Contemporary Trust in the Source Country

4.2.1 Inherited Trust

In this section, we estimate the evolution of trust transmitted from the ancestors' home country through US immigrants following Algan and Cahuc (2010), on a pooled sample of 22 waves of the GSS (1978-2014). We use the following mechanism to estimate inherited trust in 1950 and 2010. First, we impose a lag of one generation (25 years) between the inherited trust and the contemporaneous level of CO_2 emissions. This implies that we observe trust attitudes that have prevailed from at least $T-25$ ago to explain the level of emissions at T. We expect this lag structure to mitigate the concern of time-varying omitted variable bias since it is then less likely that some common factors simultaneously drive emissions at T and trust that prevailed from at least one generation ago.

[11] In terms of data availability, this period allows the largest number of countries of origin to be available for which the measure of inherited trust can be constructed with 10 or more observations.

[12] For instance, the first World Climate Conference was held in Geneva in 1979, convened by the World Meteorological Organization (WMO), with its main focus being global warming and how it could affect human activity.

Then, respondents (who are descendants of US immigrants) are grouped into two cohorts, the 1950 cohort and the 2010 cohort, based on the information from the respondents' birth year and their immigrant generation. With a lag of 25 years explained above, inherited trust in 1950 is then that of second-generation Americans born before 1925 (i.e., those whose parents must have arrived in America before 1925), of third-generation Americans born before 1950 (i.e., those whose parents were born in the US before 1925 and therefore whose immigrant grandparents arrived in America before 1925), and that of fourth-generation Americans born before 1975 (i.e., following the same logic, whose great-grandparents arrived in America before 1925). Similarly, inherited trust in 2010 is that of second-generation Americans born between 1925 and 1985, of third-generation Americans born after 1950, and that of fourth-generation Americans born after 1975. Table A1 reports the number of observations for these two cohorts by their country of origin. Table A2 presents the summary statistics of the respondents.

We run a single regression in equation (2) with interaction terms between cohort dummies and country of origin dummies to provide evidence for time and source-country variation in inherited trust:

$$Trust_i = \alpha_0 + \sum_{c=1}^{26} \sum_{g=1950,\ 2010} \alpha_1 CO_c * G_g + \alpha_2 X_i + Y_t + \epsilon_i \tag{2}$$

where $Trust_i$ is the trust of the descendant of a US immigrant i, CO_c country of origin dummies, and G_g cohort dummies. X_i is a vector of individual-level controls that include age, gender, education, employment status, religion, and income categories. We also control for survey year dummies Y_t to account for common temporal shocks.[13] Table 1 reports the coefficients of the interaction terms between the cohort and country of origin dummies (α_1) that reflect inherited trust of the 1950 cohort and 2010 cohort from different home countries. Swedish Americans in the 1950 cohort are used as the reference group. Standard errors are clustered at the country-of-origin level.[14]

Column 1 presents the estimates for the inherited trust of the 1950 cohort relative to trust inherited by Swedish Americans in the same cohort. The results suggest

[13]In another specification, we also try to include the parents' education to address the possibility that trust is transmitted through parents' human capital rather than cultural transmission and find similar results.

[14]We also cluster standard errors treating all European countries as one cluster, accounting for the correlation in the cultural and institutional environment within the continent. We find standard errors that are very similar to those clustered at the country-of-origin level (not reported).

that having ancestors from a country that is not Sweden has a statistically significant effect on one's inherited trust. The level of trust inherited in 1950 from most Western and Central European countries or the United Kingdom tends to be higher than that inherited from Sweden. The probability of trusting other people is 9.2 percentage points higher for Austrian Americans and 1.2 percentage points higher for British Americans. On the other hand, inherited trust in 1950 is lower for most Eastern European and Mediterranean countries. The probability of trusting others is 2.3 and 4.8 percentage points lower for Czech Americans and for Italian Americans, respectively. Inherited trust in 1950 is also lower for countries in other regions such as India and Japan, as well as in Africa.

Column 2 reports the inherited trust of the 2010 cohort relative to trust inherited by Swedish Americans in 1950. The estimates suggest substantial time variation in inherited trust for most home countries. We find here that the pattern in the evolution of inherited trust is remarkably similar to what Algan and Cahuc (2010) documented in their paper, although we consider a slightly different period (their baseline period was 1935–2000).[15]

4.2.2 Correlation between Inherited Trust and Contemporary Trust in the Source Country

Having estimated inherited trust from the descendants of US immigrants, we now document the relationship between the estimated inherited trust and the current level of trust in the home countries. We expect to find a strong correlation between inherited trust and current trust back in the home country if the channel of cultural transmission within families was at work.

In line with Algan and Cahuc (2010), we estimate the same regression that we ran above but replace the country-of-origin fixed effects with the current average level of trust in the home countries in 2010 provided by the World Value Survey and the European Social Survey.[16] Columns 1 and 2 in Table 2 show the results for descendants

[15]We report the effect of other individual characteristics on trust in Table A3. Trust is positively correlated with age, education, and income as documented by previous studies (Alesina and La Ferrara, 2002; Glaeser et al., 2002).

[16]One might be concerned about the potential compatibility issues of using two different surveys to construct a variable (although the wording of the trust question in the two surveys is identical). Thus, we also try to restrict the sample to only respondents whose ancestors came from European countries and use the ESS to calculate the current level of trust. The results are reported in Table OA1 in the Supplementary Online Appendix (available at the authors' websites) and they are qualitatively

of US immigrants who have inherited trust from their ancestors in 2010 and 1950, respectively. Column 1 indicates that for the 2010 period, the level of average trust in the ancestors' home country is a statistically significant predictor of the inherited trust of Americans who are born and raised in the US but have ancestors who came from the same country. This provides strong evidence for the role of cultural transmissions within families. We also find a similar relationship for the 1950 period (column 2), but with larger standard errors. This indicates that the contemporaneous trust in the ancestors' home country does not predict trust inherited much earlier (before 1925) as precisely as it predicts trust inherited more recently. This is consistent with the time variation in inherited trust we observed in the previous section. Figure 2 visually shows the correlation between trust in the ancestors' home country and trust inherited by US immigrants for each cohort.

An alternative interpretation of time variation in inherited trust is that trust attitudes of immigrants in the 1950 cohort have converged to those of their American offspring as the time spent in the host country increases. However, we have seen in Table 1 that there are statistically significant differences in inherited trust across countries of origin for immigrants in the 1950 cohort, which would not have been the case had there been a strong convergence in beliefs.[17] Focusing on the fourth-generation immigrants in the 2010 cohort (for whom a longer period has passed since trust was transmitted by their immigrant ancestors) provides a consistent result. Trust in the ancestors' home country in 2010 is still a statistically significant predictor of their current trust (Table A4).[18]

consistent with what we find and discuss in this section.

[17]The literature also provides a large body of evidence of the persistence of cultural norms and beliefs. For example, important economic decisions such as living arrangements (Giuliano, 2007) and labor market participation (Fernandez, 2007; Fernandez and Fogli, 2009) of second-generation immigrants born and raised in the US are strongly predicted by the norms in their countries of origin, rather than converging to those of Americans.

[18]A related concern is that trust held by immigrants belonging to different cohorts from the same home country could also have converged through close interpersonal interactions. Table 1 provides counter-evidence for this concern. For all but three countries, we reject the hypothesis that coefficients across the two cohorts are equal. This should not have been the case if there was a strong convergence across different cohorts from the same home country.

4.3 Role of Inherited Trust in Reducing CO_2 Emissions

4.3.1 Baseline Estimation

In this section, we discuss the findings from our baseline estimation with country fixed effects.[19] The dependent variable is log per capita CO_2 emissions relative to that of Sweden in 1950 and 2010. To smooth out short-run fluctuations, we use three-year averages over 1950-1952 and 2008-2010 for 1950 and 2010, respectively. Descriptive statistics for the dataset used in this section are shown in Table A5. The explanatory variable of interest is the level of inherited trust measured by the coefficients associated with the country-of-origin fixed effects in the individual level regression based on the GSS. We run separate regressions for 1950 and 2010, using Swedish Americans in 1950 and 2010 as the reference (thus omitted) group, respectively.

Table 3 presents the cross-country correlation between the change in inherited trust and the change in the level of per capita CO_2 emissions between 1950 and 2010. In our baseline estimation, we control for the level of economic development measured by log per capita GDP, the share of manufacturing in the economy, and openness to trade in an attempt to account for the influence of trade on pollution. The historical data on the sectoral composition of economies around the world come from Mitchell (2013). For data on openness to trade, we rely on the Penn World Table that provides national accounts data in US dollars from 1950. The variable is calculated by dividing the sum of exports and imports by GDP.

The coefficient on inherited trust is negative and statistically significant in our baseline specification that includes all the controls we mentioned above (column 1). This implies that countries that have experienced a larger increase in inherited trust have more substantially reduced CO_2 emissions.[20] An alternative trust measure that

[19] The within specification addresses the concern of time-invariant omitted variable bias. Additionally, noting that high-trust, rich countries have taken the initiative to reduce emissions earlier than developing countries, the cross-sectional correlation between trust and CO_2 emissions might be different across the two years we pool together. Thus, to precisely capture how a change in trust within a country is associated with a change in CO_2 emissions in the same country irrespective of the initial level of emissions, we include country fixed effects in all our specifications.

[20] One might be concerned about the uncertainty rising from using estimated coefficients as a variable, although most of them are precisely estimated. We aimed to get a sense of this uncertainty by (1) randomly drawing 1,000 values from the distributions of the point estimates associated with fixed effects, (2) running 1,000 regressions using each of these 1,000 "versions" of the inherited trust measure, and (3) seeing if the level of significance or the magnitude of the coefficient of inherited trust differs greatly from our baseline estimation. We found that the uncertainty is minimal. The empirical confidence interval of the coefficient of the inherited trust measure does not include zero and the variable is significant at a 5 percent level close to 99% of the time.

controls for the parents' education (to control for the possibility that inherited trust is a product of parents' human capital) yields similar results (column 2). We provide further tests by excluding potential outliers. We have excluded Africa because the whole continent is considered as one country and this treatment might contaminate the results, but we find a very similar estimate (column 3). Excluding Nordic countries, in case these high-trust countries are driving the results, also does not affect the result (column 4).[21] We believe that these findings provide support for our hypothesis that the culture of cooperation between trustworthy individuals within a country positively affects global cooperative behavior.

4.3.2 Falsification Test

As mentioned earlier, the strategy of focusing on the inherited component of trust and going far back enough in time to allow for inherited trust to evolve comes at a cost of including an era when there was no prior awareness of man-made climate change in our context. Being mindful of this limitation, we run a falsification test on the period when there was no previous expectation of a relationship between trust and CO_2 emissions. According to our search on the media database Factiva, newspaper articles were regularly written on the warming effects of carbon dioxide emissions and the use of fossil fuels starting from the 1980s and since then, the topic has become a major political issue in many developed countries with varying degrees of intensity. Thus, we consider the period between 1920 and 1980 for our falsification test as a period void of the public's awareness of climate change.

The way we estimate inherited trust for 1920 and 1980 is the same as the way we proceeded in Section 4.2.1. Inherited trust in 1920 is that of second-generation Americans born before 1895, of third-generation Americans born before 1920, and of fourth-generation Americans born before 1945. Similarly, inherited trust in 1980 is that of second-generation Americans born between 1895 and 1955, of third-generation Americans born between 1920 and 1980, and of fourth-generation Americans born after 1945. We only keep countries of origin with a minimum of 10 observations in the individual regressions on the trust question, which leaves us with 19 countries.[22]

[21] We also tried excluding Czechoslovakia, Yugoslavia, and Russia for which the trade openness variable in the year 1950 takes the value of 1990 as this is the earliest available data for these countries (as we explain in section A4 of the Appendix) and still found the same results with a p-value 0.018.

[22] For coherence, we re-estimate the relationship between inherited trust and per capita CO_2 emissions between 1950 and 2010 on this restricted sample of 19 countries. We find a coefficient (standard

We report the number of observations and descriptive statistics for each cohort and country of origin in Table OA2 and OA3, respectively, in the Supplementary Online Appendix available at the authors' websites. As mentioned before, inherited trust is measured by the coefficients associated with the country-of-origin fixed effects in the individual level regressions based on the GSS, controlling for age, gender, education, employment status, religion, and income categories (Table OA4). We observe a strong correlation between inherited trust of immigrants and trust in their origin countries in this cohort decomposition (Table OA5).

We report the results from the falsification test in Table 4. When we move the time window to 1920–1980, the effect of inherited trust on the level of CO_2 emissions is positive and imprecisely estimated (column 1). We find this reassuring as we hypothesized that the increase in trust would not affect the change in the level of emissions during this early period because the concern for climate change had not yet emerged. On the other hand, per capita GDP remains positive and statistically significant, which is intuitive as we still expect the scale effect to be in place. Next, we try to replicate the findings of Algan and Cahuc (2010) on the effect of inherited trust on economic growth during this period. Unlike the relationship between trust and CO_2 emissions, the documented effect of trust on economic growth should not be contingent on specific time periods and thus we would still expect to see a positive effect of inherited trust on per capita GDP. Columns 2 and 3 confirm this intuition. Indeed, the inherited trust variable is associated with a significant and positive coefficient and the relationship is robust to the inclusion of the initial level of economic development and the quality of political institutions (measured by the Polity 2 variable from the Polity IV database used in Algan and Cahuc (2010)).[23]

4.3.3 Robustness Checks

In this section, we test the sensitivity of the estimated relationship between inherited trust and CO_2 emissions with three robustness checks. First, we increase the lag between inherited trust and the level of emissions to two generations (50 years) to further reduce the concern of time-varying omitted variable bias as noted in Algan and Cahuc (2010). We update the cohort decomposition described in Section 4.2.1

errors) of -2.702 (1.473), which is very similar in magnitude to that reported in Table 3.

[23]We use per capita GDP in 1870 and 1920 as the level of initial economic development for 1920 and 1980, respectively.

using a 50-year lag.[24] We keep countries of origin with at least 10 observations in the individual regression on the trust question, which leaves us with 23 countries.

Again, inherited trust is measured by the coefficients associated with the country-of-origin fixed effects in the individual level regressions based on the GSS, controlling for age, gender, education, employment status, religion, and income categories. We run separate regressions for 1950 and 2010 using Swedish Americans as the reference group in both periods.[25]

Table 5 presents the estimated effect of the change in inherited trust on the change in the level of CO_2 emissions between 1950 and 2010 with a lag of 50 years. We include the same set of controls used above with country fixed effects. The results are qualitatively similar to those we found in the baseline estimation.

Next, we study different periods to ensure that our results do not hinge on specific characteristics of the period on which we have focused so far. Since going further back in time may not be any more informative (as then we will be including more of the period in which there was no awareness of climate change), we instead consider a shorter window of the period between 1970 and 2010. We use the same cultural transmission model to estimate inherited trust for 1970 and 2010.[26] Taking a conservative approach, we use a lag of 50 years that allows for more observations simultaneously.[27]

Table 6 presents the estimated effects of the changes in inherited trust on the

[24]Inherited trust in 1950 is now that of second-generation Americans born before 1900 (i.e., those whose parents arrived in America before 1900), of third-generation Americans born before 1925 (i.e., those whose parents were born in the US before 1900 and therefore whose immigrant grandparents arrived in America before 1900), and of fourth-generation Americans born before 1950 (i.e., following the same logic, whose great grandparents arrived in America before 1900). Similarly, inherited trust in 2010 is that of second-generation Americans born between 1900 and 1960, of third-generation Americans born after 1925, and of fourth-generation Americans born after 1950.

[25]The number of observations and descriptive statistics for each cohort and country of origin are reported in Table OA6 and OA7, respectively. As mentioned before, inherited trust is measured by the coefficients associated with the country-of-origin fixed effects in the individual level regressions based on the GSS, controlling for age, gender, education, employment status, religion, and income categories (Table OA8). We observe a strong correlation between inherited trust of immigrants and trust in their origin countries in this cohort decomposition (Table OA9).

[26]Inherited trust in 1970 is that of second-generation Americans born before 1920, of third-generation Americans born before 1945, and of fourth-generation Americans born before 1970. Similarly, inherited trust in 2010 is that of second-generation Americans born between 1920 and 1960, of third-generation Americans born after 1945, and of fourth-generation Americans born after 1970.

[27]Again, the number of observations and descriptive statistics for each cohort and country of origin are reported in Table OA10 and OA11, respectively. Inherited trust is measured by the coefficients associated with the country-of-origin fixed effects in the individual-level regressions based on the GSS, controlling for age, gender, education, employment status, religion, and income categories (Table OA12). We observe a strong correlation between inherited trust of immigrants and trust in their origin countries in this cohort decomposition (Table OA13).

changes in the level of CO_2 emissions between 1970 and 2010 with the lag of 50 years. We again control for per capita GDP, the share of manufacturing sector, and openness to trade as well as country fixed effects. The findings are qualitatively similar to those we found in the previous sections even when we look at different periods. Inherited trust seems to be a statistically significant factor in explaining the heterogeneity of the level of emissions across countries.

Finally, we include additional controls to further check for omitted variable bias. First, given that developed countries started to take the initiative to reduce CO_2 emissions earlier than developing countries, we aim to control for an earlier level of income (lagged by 50 years) in case the current level of CO_2 emissions is driven by this. Further, we control for the quality of political institutions that could be correlated with the level of trust that also might affect emissions (through environmental policies, for example) using the Polity IV dataset. Next, to account for the possibility that general education, which could correlate with the willingness to cooperate globally, might have co-evolved with trust over time, we control for the share of the population with primary education. Finally, we aim to control for urbanization rate and population density which are related to a country's energy consumption patterns.[28] We proceed with our baseline specification with the lag of 25 years between inherited trust and emissions over the period of 1950-2010.

Table 7 reports the results of the regressions that include these additional controls. In addition to our baseline controls, column 1 adds log income per capita lagged by 50 years and column 2 includes the Polity 2 variable from the Polity IV dataset. Column 3 controls for primary school enrolment. In columns 4 and 5, we add urbanization and population density measures, respectively. The effect of the change in inherited trust remains robust to the inclusion of these additional controls. Although not reported, we also check the influence of FDI flows that may influence CO_2 emissions through the pollution haven effects (Cole et al., 2006) and find that the estimated effect of inherited trust on CO_2 emissions remains unaffected.

[28]For historical data on primary school enrolment, we rely on Lee and Lee (2016). Former Yugoslavian countries are missing in the dataset. The data on urbanization and population density come from the World Bank.

5 Discussion

5.1 Alternative Interpretations

Based on our conceptual framework and the falsification test, we interpret our results as evidence for higher willingness to engage in global cooperation in high-trust societies. However, the potential ancillary benefits of local pollution regulation on CO_2 emissions and the local benefits of climate change policies suggest two alternative interpretations of our findings, which we discuss carefully below.

First, one might argue that high-trust countries are more effective in local pollution abatement efforts (through better collective action), which could have led to concurrent reductions in CO_2 emissions due to spillover effects or complementarity between local and global pollutants. Thus, the more substantial reductions in CO_2 emissions in high-trust countries we observe may merely be a by-product of their successful local pollution regulations rather than their willingness to contribute to the global collective action. However, there is a dearth of empirical evidence for the ancillary benefits of local pollution abatement on reducing global pollutants and the few existing studies report findings against such global spillover effects of local pollution regulation. Holland (2012) studies the effects of NO_x regulation of power plants in California on CO_2 emissions and shows that all the reduction in CO_2 emissions that followed the tightening of NO_x regulation was due to the reduction in output (which we control for by GDP per capita), rather than due to a complementarity between NO_x and CO_2. Brunel and Johnson (2019) expands the scope of this analysis to all manufacturing industries in the United States and finds similar results. The authors exploit exogenous variation made available by changes in air quality standards under the Clean Air Act and compare counties that did not meet the new standards and therefore had to face more stringent regulation (non-attainment counties) with counties that met the standards and faced no more stringent regulation than the status quo (attainment counties). They find no evidence that local and global pollutants are complementary —there was no statistically significant difference in the pattern of CO_2 emissions between non-attainment and attainment counties, while local pollutants fell substantially in non-attainment counties. Thus, we believe it is unlikely that our estimated relationship between trust and CO_2 emissions is driven by spillover effects of local pollution abatement efforts on CO_2 emissions.

Second, another alternative interpretation may be that high-trust countries expect

larger local benefits from climate change mitigation. A direct way to check this possibility is to look at the predicted damage from climate change: high-trust countries might have more greatly reduced greenhouse gas emissions because they expect larger damage from climate change. We observe the opposite in reality. Using the Vulnerability Index, which is part of the University of Notre Dame Global Adaptation Index and measures a country's exposure, sensitivity, and capacity to adapt to the negative effects of climate change (Chen et al., 2015), Figure 3 shows a negative correlation between the degree of vulnerability to (and therefore expected damage from) climate change and inherited trust in 2010 across countries. Thus, it is clear that high-trust countries tend to be more cooperative in climate change mitigation efforts even though they face smaller damage from climate change.

5.2 Mechanisms

Our analysis yields strong empirical evidence of the positive relationship between trust and CO_2 emissions across countries. In light of our conceptual framework that implies that interpersonal trust shared in a society positively affects individuals' willingness to cooperate globally, we consider two potential mechanisms underlying our results at the individual and institutional level.

First, there exists substantial empirical evidence that interpersonal trust is positively correlated with climate-friendly behavior at the individual level. Carattini et al. (2019) reviews this literature and concludes that trust, or social norms at large, can induce individuals' climate-friendly behavior especially when their action is salient. Furthermore, in a meta-analysis of 72 studies on how social norms are correlated with preferences towards climate change policies, Alló and Loureiro (2014) concludes that cooperative social norms are strongly associated with a higher willingness to pay for climate change mitigation. Using data on 60 countries, Tam and Chan (2018) similarly reports that individuals with a high level of trust expect others to be cooperative and therefore tend to be more cooperative themselves not only by being more concerned about climate change issues but also by actually behaving in a pro-environmental manner. Similarly, Volland (2017) uses data from the British Household Panel Survey and finds that generalized trust is negatively correlated with household energy demand. From three surveys of European respondents, Carattini and Roesti (2020) also finds that people with higher trust are more likely to engage in a wide range of pro-social and pro-environmental behaviors and concludes that individuals may enjoy being co-

operative rather than constantly maximizing their income.

Second, cooperative attitudes observed in individuals with high levels of trust are likely to translate to formal legislation through the voting for political parties (Gifford and Nilsson, 2014) or stronger support for government action aimed at climate change mitigation (Alló and Loureiro, 2014). In line with this argument, there exists a positive correlation between trust and the adoption of climate policy in a cross-section of countries as we have seen in Figures 1 and A1. In a similar spirit, Owen and Videras (2008) analyze the adoption of Local Agenda 21 programs, which are local initiatives aimed at addressing global environmental problems. They find a strong positive relationship between interpersonal trust shared in a country and the adoption of sustainability measures.

Furthermore, while a strong emphasis is placed on international environmental agreements, there are several examples where countries, often associated with high generalized trust, implemented unilateral climate policies that led to lower emissions well before the Kyoto Protocol came into effect in 2005. Several Scandinavian countries, for example, started taxing carbon in the early 1990s. Sweden introduced a carbon tax in 1991, which led to a substantial reduction in emissions, including in the period 1990-2004 (Andersson, 2019). Similarly, the climate change levy in the UK reduced emissions intensity in manufacturing firms by approximately 20 percent between 2001 and 2004 (Martin et al., 2014).

The observed cross-country correlation between trust and climate change policy is underpinned by theoretical explanations from the international environmental agreements literature that emphasize trust and reciprocity of state actors (Hadjiyiannis et al., 2012; Hovi et al., 2015; Buchholz and Sandler, 2017; Marchiori et al., 2017; Nyborg, 2018). In a review of models of climate cooperation, for example, Hovi et al. (2015) discusses a class of models where trust and reciprocity play a vital role in sustaining a cooperative equilibrium. A trusting state may signal its type by engaging in a costly abatement effort, which is then reciprocated by other conditionally cooperating states with small but increasing abatement efforts. The authors view the EU's pledges for mitigation efforts (for instance, the early pledge to the Paris Agreement in the spring of 2015) as an example of the first move that led to other states' reciprocal responses. Nyborg (2018) incorporates reciprocal preferences in a standard non-cooperative abatement game and shows that reciprocity of the state actors plays a role in climate negotiations which are essentially a coordination game where trust

is important. Although a rigorous econometric analysis of how trust affects climate change policy is difficult due to the lack of long time-variation in such institutional measures, we believe these theoretical analyses reinforce the institutional channel as a strong mechanism behind our empirical evidence on the association between trust and CO_2 emissions across countries.

6 Conclusion

Given the long-standing literature on local social norms and cooperation, we have attempted to move one step forward by studying whether local social norms could have implications for *global* cooperation. By adopting an identification strategy that allows us to include country fixed effects, we estimate the effect of inherited trust on the reduction in CO_2 emissions and find that countries that have experienced a larger increase in trust have reduced CO_2 emissions per capita more substantially. Our findings emphasize the importance of social norms that have been largely overlooked by economists in governing the global commons.

Despite the strong reduced-form evidence our analysis provides, there is ample room for improvement and future research. In particular, our findings encourage more research (both qualitative and quantitative) on specific processes in which individual preferences translate to formal legislation, which we discuss as one of the mechanisms underlying our empirical results. A deeper understanding of such processes could allow relying on norms and beliefs as a policy tool to complement the formal institutional approach to tackle climate change.

References

Aghion, P., Y. Algan, and P. Cahuc (2011). Civil society and the state: The interplay between cooperation and minimum wage regulation. *Journal of the European Economic Association 9*(1), 3–42.

Aghion, P., Y. Algan, P. Cahuc, and A. Schleifer (2010). Regulation and distrust. *The Quarterly Journal of Economics 125*(3), 1015–1049.

Alesina, A. and E. La Ferrara (2002). Who trusts others? *Journal of Public Economics 85*(2), 207–234.

Algan, Y. and P. Cahuc (2009). Civic virtue and labor market institutions. *American Economic Journal: Macroeconomics 1*(1), 111–145.

Algan, Y. and P. Cahuc (2010). Inherited trust and growth. *The American Economic Review 100*(5), 2060–2092.

Algan, Y. and P. Cahuc (2013). Trust and growth. *Annual Review of Economics 5*(1), 521–549.

Alló, M. and M. L. Loureiro (2014). The role of social norms on preferences towards climate change policies: A meta-analysis. *Energy Policy 73*, 563–574.

Andersson, J. J. (2019). Carbon taxes and CO_2 emissions: Sweden as a case study. *American Economic Journal: Economic Policy 11*(4), 1–30.

Antweiler, W., B. R. Copeland, and M. S. Taylor (2001). Is free trade good for the environment? *The American Economic Review 91*(4), 877–908.

Azomahou, T., F. Laisney, and P. N. Van (2006). Economic development and CO2 emissions: A nonparametric panel approach. *Journal of Public Economics 90*(6-7), 1347–1363.

Bolt, J. and J. L. Van Zanden (2014). The Maddison Project: collaborative research on historical national accounts. *The Economic History Review 67*(3), 627–651.

Brick, K. and M. Visser (2015). What is fair? An experimental guide to climate negotiations. *European Economic Review 74*, 79–95.

Brunel, C. and E. P. Johnson (2019). Two birds, one stone? Local pollution regulation and greenhouse gas emissions. *Energy Economics 78*, 1–12.

Buchholz, W. and T. Sandler (2017). Successful leadership in global public good provision: Incorporating behavioural approaches. *Environmental and Resource Economics 67*(3), 591–607.

Carattini, S., M. Carvalho, and S. Fankhauser (2018). Overcoming public resistance to carbon taxes. *Wiley Interdisciplinary Reviews: Climate Change 9*(5), e531.

Carattini, S., S. Levin, and A. Tavoni (2019). Cooperation in the climate commons. *Review of Environmental Economics and Policy 13*(2), 227–247.

Carattini, S. and M. Roesti (2020). Trust, happiness, and pro-social behavior. *CESifo Working Paper No. 8562*.

Chen, C., I. Noble, J. Hellmann, J. Coffee, M. Murillo, and N. Chawla (2015). University of Notre Dame Global Adaptation Index: Country Index Technical Report. *Technical Report*.

Cole, M. A., R. J. Elliott, and P. G. Fredriksson (2006). Endogenous pollution havens: Does FDI influence environmental regulations? *Scandinavian Journal of Economics 108*(1), 157–178.

Copeland, B. R. and M. S. Taylor (2005). Free trade and global warming: A trade theory view of the Kyoto protocol. *Journal of Environmental Economics and Management 49*(2), 205–234.

Drews, S. and J. C. Van den Bergh (2016). What explains public support for climate policies? A review of empirical and experimental studies. *Climate Policy 16*(7), 855–876.

EBRD (2011). Political economy of climate change policy in the transition region. Technical report, European Bank of Reconstruction and Development.

Gifford, R. and A. Nilsson (2014). Personal and social factors that influence pro-environmental concern and behaviour: A review. *International Journal of Psychology 49*(3), 141–157.

Glaeser, E. L., D. Laibson, and B. Sacerdote (2002). An economic approach to social capital. *The Economic Journal 112*(483), F437–F458.

Grossman, G. M. and A. B. Krueger (1991). Environmental impacts of a North American free trade agreement. Technical report, National Bureau of Economic Research.

Grossman, G. M. and A. B. Krueger (1995). Economic growth and the environment. *The Quarterly Journal of Economics 110*(2), 353–377.

Guiso, L., P. Sapienza, and L. Zingales (2004). The role of social capital in financial development. *The American Economic Review 94*(3), 526–556.

Guiso, L., P. Sapienza, and L. Zingales (2006). Does culture affect economic outcomes? *The Journal of Economic Perspectives 20*(2), 23–48.

Guiso, L., P. Sapienza, and L. Zingales (2009). Cultural biases in economic exchange? *The Quarterly Journal of Economics 124*(3), 1095–1131.

Hadjiyiannis, C., D. İriş, and C. Tabakis (2012). International environmental cooperation under fairness and reciprocity. *The BE Journal of Economic Analysis & Policy 12*(1).

Hauser, O. P., A. Hendriks, D. G. Rand, and M. A. Nowak (2016). Think global, act local: Preserving the global commons. *Scientific reports 6*, 36079.

Holland, S. P. (2012). *"The Design and Implementation of US Climate Policy" in Don Fullerton and Catherine Wolfram, eds.* University of Chicago Press.

Hovi, J., H. Ward, and F. Grundig (2015). Hope or despair? Formal models of climate cooperation. *Environmental and Resource Economics 62*(4), 665–688.

Jo, A. (2021). Culture and compliance: Evidence from the European Union Emissions Trading Scheme. *The Journal of Law and Economics 64*(1), 181–205.

Jo, A. and S. Carattini (2021). Replication Data for: Trust and CO2 Emissions: Cooperation on a Global Scale. *Harvard Dataverse.* https://doi.org/10.7910/DVN/1MIV1Z.

Jordan, J. J., M. Hoffman, M. A. Nowak, and D. G. Rand (2016). Uncalculating cooperation is used to signal trustworthiness. *Proceedings of the National Academy of Sciences 113*(31), 8658–8663.

Kandori, M. (1992). Social norms and community enforcement. *The Review of Economic Studies 59*(1), 63–80.

Klenert, D., L. Mattauch, E. Combet, O. Edenhofer, C. Hepburn, R. Rafaty, and N. Stern (2018). Making carbon pricing work for citizens. *Nature Climate Change 8*(8), 669–677.

Knack, S. and P. Keefer (1997). Does social capital have an economic payoff? A cross-country investigation. *The Quarterly Journal of Economics*, 1251–1288.

La Porta, R., F. Lopez-de Silanes, A. Shleifer, and R. W. Vishny (1997). Trust in large organizations. *The American Economic Review 87*(2), 333.

Lee, J.-W. and H. Lee (2016). Human capital in the long run. *Journal of Development Economics 122*, 147–169.

Levinson, A. (2009). Technology, international trade, and pollution from US manufacturing. *American Economic Review 99*(5), 2177–92.

Marchiori, C., S. Dietz, and A. Tavoni (2017). Domestic politics and the formation of international environmental agreements. *Journal of Environmental Economics and Management 81*, 115–131.

Martin, R., L. B. de Preux, and U. J. Wagner (2014). The impact of a carbon tax on manufacturing: Evidence from microdata. *Journal of Public Economics 117*, 1–14.

Milinski, M., D. Semmann, and H.-J. Krambeck (2002). Reputation helps solve the 'tragedy of the commons'. *Nature 415*(6870), 424–426.

Milinski, M., D. Semmann, H.-J. Krambeck, and J. Marotzke (2006). Stabilizing the earth's climate is not a losing game: Supporting evidence from public goods experiments. *Proceedings of the National Academy of Sciences of the United States of America 103*(11), 3994–3998.

Milinski, M., R. D. Sommerfeld, H.-J. Krambeck, F. A. Reed, and J. Marotzke (2008). The collective-risk social dilemma and the prevention of simulated dangerous climate change. *Proceedings of the National Academy of Sciences 105*(7), 2291–2294.

Mitchell, B. (2013). International historical statistics.

Nunn, N. and L. Wantchekon (2011). The slave trade and the origins of mistrust in Africa. *The American Economic Review 101*(7), 3221–3252.

Nyborg, K. (2018). Reciprocal climate negotiators. *Journal of Environmental Economics and Management 92*, 707–725.

Okuno-Fujiwara, M. and A. Postlewaite (1995). Social norms and random matching games. *Games and Economic Behavior 9*(1), 79–109.

Ostrom, E. (2000). Social capital: A fad or a fundamental concept. *Social capital: A multifaceted perspective 172*(173), 195–98.

Owen, A. L. and J. Videras (2008). Trust, cooperation, and implementation of sustainability programs: The case of Local Agenda 21. *Ecological Economics 68*(1-2), 259–272.

Poteete, A. R., M. A. Janssen, and E. Ostrom (2010). *Working Together: Collective Action, The Commons, and Multiple Methods in Practice*. Princeton University Press.

Putnam, R. D. (2000). Bowling alone: America's declining social capital. In *Culture and politics*, pp. 223–234. Springer.

Rafaty, R. (2018). Perceptions of corruption, political distrust, and the weakening of climate policy. *Global Environmental Politics 18*(3), 106–129.

Rice, T. W. and J. L. Feldman (1997). Civic culture and democracy from Europe to America. *The Journal of Politics 59*(04), 1143–1172.

Tabellini, G. (2010). Culture and institutions: Economic development in the regions of Europe. *Journal of the European Economic Association 8*(4), 677–716.

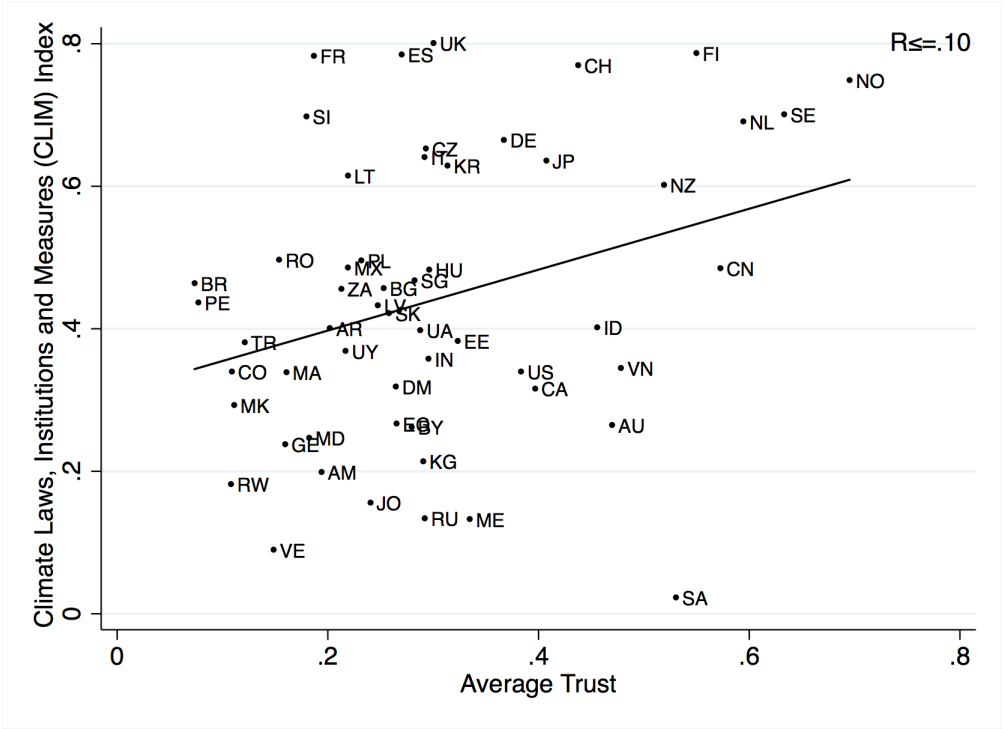
Tam, K.-P. and H.-W. Chan (2018). Generalized trust narrows the gap between environmental concern and pro-environmental behavior: Multilevel evidence. *Global Environmental Change 48*, 182–194.

Tavoni, A., A. Dannenberg, G. Kallis, and A. Löschel (2011). Inequality, communication, and the avoidance of disastrous climate change in a public goods game. *Proceedings of the National Academy of Sciences 108*(29), 11825–11829.

Volland, B. (2017). The role of risk and trust attitudes in explaining residential energy demand: Evidence from the United Kingdom. *Ecological Economics 132*, 14–30.

Zak, Paul J and, S. (2001). Trust and growth. *The Economic Journal 111*(470), 295–321.

Figure 1: Correlation between Trust and the Climate Laws, Institutions and Measures (CLIM) Index



Note: the graph plots the relationship between the level of average trust and the the Climate Laws, Institutions and Measures (CLIM) Index. The CLIM Index comes from EBRD (2011). The level of average trust measure is constructed based on the World Value Survey (1984-2014).

Table 1: Inherited Trust in 1950 and 2010

	Dependent variables			
	Inherited trust in 1950		Inherited trust in 2010	
	Coefficient	SD	Coefficient	SD
Country of Origin	Reference: Swedish ancestors - 1950			
Sweden			0.036***	(0.007)
Africa	-0.237***	(0.006)	-0.169***	(0.016)
Austria	0.092***	(0.007)	-0.065***	(0.008)
Begium	0.253***	(0.010)	0.044***	(0.011)
Canada	0.003	(0.011)	0.074***	(0.013)
Czechoslovakia	-0.023***	(0.008)	-0.007	(0.008)
Denmark	0.073***	(0.002)	0.153***	(0.004)
France	0.006	(0.005)	-0.054***	(0.009)
Finland	0.009	(0.008)	0.016***	(0.004)
Germany	0.007***	(0.002)	-0.007	(0.009)
Greece	0.114***	(0.006)	-0.185***	(0.005)
Hungary	0.080***	(0.006)	-0.039***	(0.005)
India	-0.186***	(0.009)	-0.197***	(0.015)
Ireland	-0.009*	(0.005)	-0.003	(0.011)
Italy	-0.048***	(0.012)	-0.091***	(0.014)
Mexico	0.007	(0.012)	-0.121***	(0.014)
Netherlands	-0.059***	(0.004)	0.021***	(0.007)
Norway	0.097***	(0.002)	0.022***	(0.005)
Poland	-0.005	(0.012)	-0.063***	(0.011)
Portugal	-0.073***	(0.008)	0.017	(0.012)
Russian Federation	-0.020***	(0.005)	-0.041***	(0.005)
Spain	-0.058***	(0.011)	0.020*	(0.011)
Switzerland	0.036***	(0.004)	0.058***	(0.005)
United Kingdom	0.012***	(0.001)	0.052***	(0.008)
Yugoslavia	-0.041***	(0.010)	0.037***	(0.010)
Japan	-0.170***	(0.007)	0.061***	(0.007)

Notes: The dependent variable is the level of trust inherited by US immigrants from the period 1950 and 2010. Additional controls included in the model are: age, age squared, gender, education, income, employment status, and religion as well as year fixed effects. Standard errors are clustered at the country level.

Source: General Social Survey: 1978-2014

Table 2: Correlation between trust of US descendants and trust in the country of origin

	Dependent variables	
	Trust of cohort 2010	Trust of cohort 1950
	(1)	(2)
Trust in source country	0.370***	0.432**
	(0.099)	(0.182)
Age	0.004***	0.003***
	(0.001)	(0.000)
Man	0.049*	0.014**
	(0.025)	(0.007)
Education	0.029***	0.036***
	(0.002)	(0.002)
Income	0.004	0.009***
	(0.003)	(0.001)
Unemployed	-0.046	0.006
	(0.031)	(0.023)
Employed	0.021	0.029**
	(0.033)	(0.011)
Catholic	0.004	0.070***
	(0.030)	(0.025)
Protestant	0.015	0.015
	(0.022)	(0.015)
Constant	-0.397***	-0.520***
	(0.050)	(0.069)
Observations	3,468	12,262
R-squared	0.065	0.084

Notes: The dependent variables in (1) and (2) are trust of immigrants in cohort 2010 and 1950, respectively. Trust in source country is the average level of trust in the country of origin of the immigrants in 2010. Standard errors are clustered at the country level.

Source: General Social Survey 1978-2014, World Values Survey and European Social Survey wave 2010.

Figure 2: Correlation between inherited trust held by descendants of US immigrants and trust in their source country

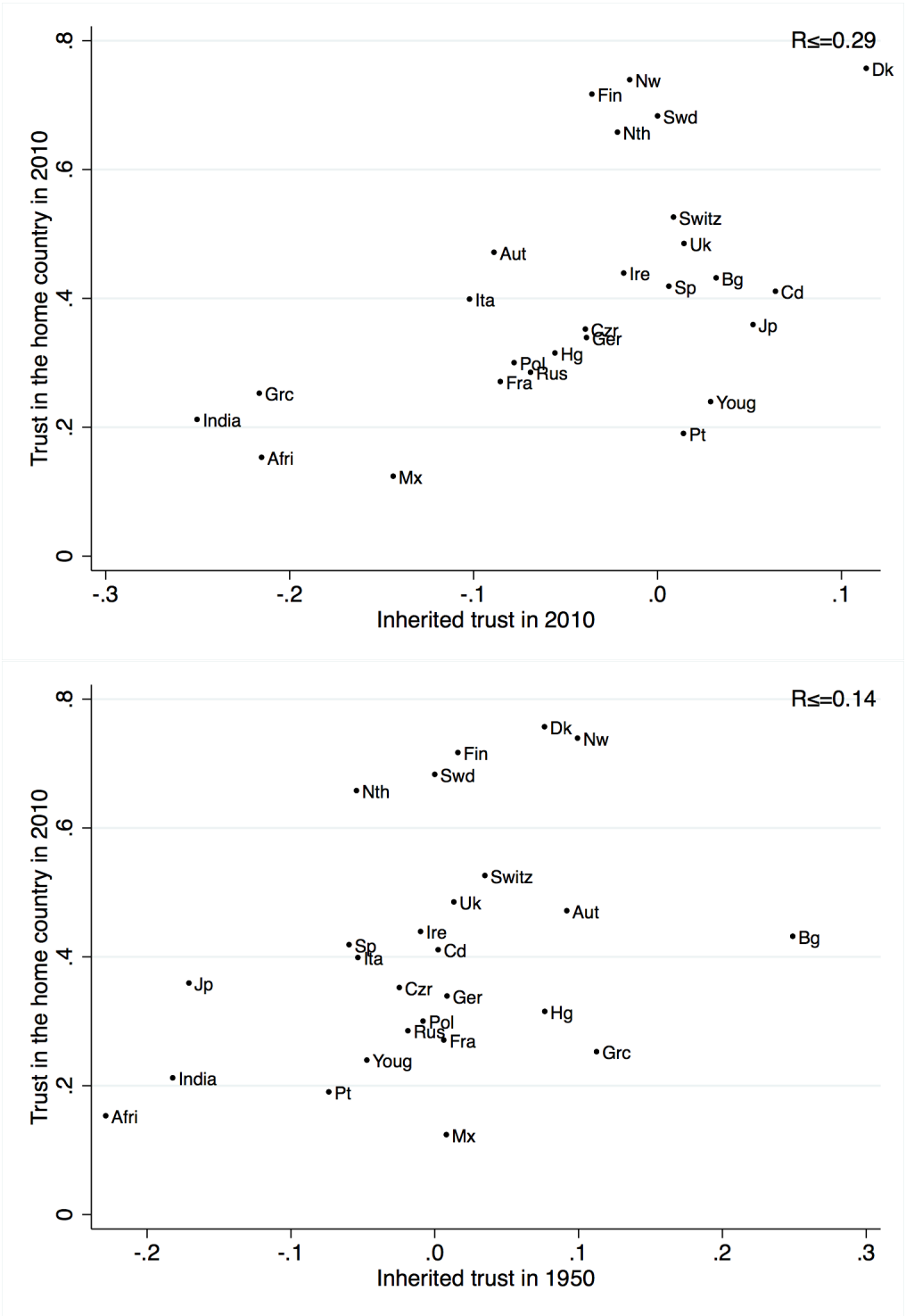


Table 3: Inherited Trust and CO_2 Emissions Per Capita in 1950 and 2010: with a 25-year lag

	Dependent variable: Log CO_2 Emissions Per Capita in 1950 and 2010			
	(1)	(2)	(3)	(4)
Inherited trust in 1950 and 2010	-2.548***	-2.529**	-2.403***	-2.629***
	(0.730)	(0.915)	(0.772)	(0.721)
Log income per capita	1.581***	1.542***	1.772***	1.535***
	(0.275)	(0.294)	(0.244)	(0.271)
Share of manufacturing	0.011	0.010	0.005	0.012
	(0.011)	(0.011)	(0.011)	(0.012)
Trade openness	-0.010**	-0.010**	-0.009**	-0.011**
	(0.004)	(0.004)	(0.004)	(0.005)
Observations	52	52	50	46
R-squared	0.892	0.891	0.889	0.895
Country fixed effects	Yes	Yes	Yes	Yes

Notes: The dependent variable is log CO_2 emissions per capita in the source countries in 1950 and 2010, relative to Sweden. Data come from the Carbon Dioxide Information Analysis Center (CDIAC). Inherited trust of US immigrants is measured relative to the inherited trust of Swedish Americans for the period 1950 and 2010 and estimated from the GSS. Data on income per capita come from the Maddison database, share of manufacturing from B.R. Mitchell (2007), and trade openness from the Penn World Table. All controls are measured relative to Sweden. Robust standard errors are reported.

Table 4: Falsification Test: Inherited Trust and CO_2 Emissions Per Capita in 1920 and 1980: with a 25-year lag

	Dependent variables		
	Log CO_2 Emissions per capita	Income Per Capita	
	(1)	(2)	(3)
Inherited trust in 1920 and 1980	1.950	12,097.023*	11,393.094*
	(1.778)	(6,456.589)	(5,632.787)
Log income per capita	1.443**		
	(0.631)		
Initial income per capita		3.259***	2.436***
		(0.914)	(0.801)
Polity 2			258.002***
			(55.961)
Observations	38	38	36
R-squared	0.676	0.859	0.893
Country fixed effects	Yes	Yes	Yes

Notes: The dependent variable in (1) is log CO_2 emissions per capita in the source countries in 1920 and 1980, relative to Sweden. Data come from the Carbon Dioxide Information Analysis Center (CDIAC). The dependent variables in (2) and (3) are income per capita in the source countries in 1950 and 2010, relative to Sweden. Inherited trust of US immigrants is measured relative to the inherited trust of Swedish Americans for the period 1920 and 1980 and estimated from the GSS. Data on income per capita come from the Maddison database. The Polity 2 variable is from the Polity IV database. All controls are measured relative to Sweden. Robust standard errors are reported.

Table 5: Inherited Trust and CO_2 Emissions Per Capita in 1950 and 2010: with a 50-year lag

	Dependent variable: Log CO_2 Emissions Per Capita in 1950 and 2010			
	(1)	(2)	(3)	(4)
Inherited trust in 1950 and 2010	-3.115***	-2.726**	-3.016***	-2.697**
	(1.039)	(1.295)	(1.006)	(1.144)
Log income per capita	1.187**	1.298**	1.144**	1.261**
	(0.504)	(0.560)	(0.500)	(0.510)
Share of manufacturing			0.012	0.010
			(0.010)	(0.011)
Trade openness				-0.006
				(0.005)
Observations	46	46	46	46
R-squared	0.873	0.860	0.881	0.889
Country fixed effects	Yes	Yes	Yes	Yes

Notes: The dependent variable is log CO_2 emissions per capita in the source countries in 1950 and 2010, relative to Sweden. Data come from the Carbon Dioxide Information Analysis Center (CDIAC). Inherited trust of US immigrants is measured relative to the inherited trust of Swedish Americans for the period 1950 and 2010 and estimated from the GSS. Data on income per capita come from the Maddison database, share of manufacturing from B.R. Mitchell (2007), and trade openness from the Penn World Table. All controls are measured relative to Sweden. Robust standard errors are reported.

Table 6: Inherited Trust and CO_2 Emissions Per Capita in 1970 and 2010: with a 50-year lag

	Dependent variable: Log CO_2 Emissions Per Capita in 1970 and 2010			
	(1)	(2)	(3)	(4)
Inherited trust in 1970 and 2010	-3.481**	-3.819***	-2.509*	-2.200*
	(1.372)	(1.351)	(1.420)	(1.258)
Log income per capita	1.564**	1.388*	1.765**	1.846***
	(0.712)	(0.722)	(0.666)	(0.623)
Share of manufacturing			-0.022***	-0.021***
			(0.007)	(0.007)
Trade openness				-0.012**
				(0.004)
Observations	52	52	52	52
R-squared	0.818	0.827	0.862	0.900
Country fixed effects	Yes	Yes	Yes	Yes

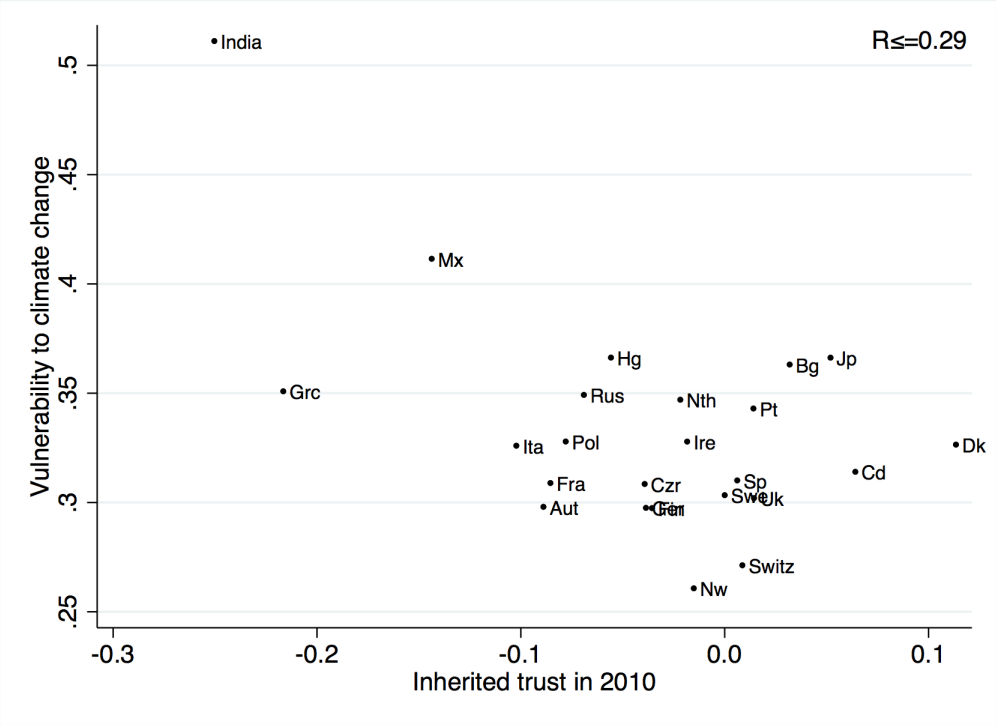
Notes: The dependent variable is log CO_2 emissions per capita in the source countries in 1970 and 2010, relative to Sweden. Data come from the Carbon Dioxide Information Analysis Center (CDIAC). Inherited trust of US immigrants is measured relative to the inherited trust of Swedish Americans for the period 1970 and 2010 and estimated from the GSS. Data on income per capita come from the Maddison database, share of manufacturing from B.R. Mitchell (2007), and trade openness from the Penn World Table. All controls are measured relative to Sweden. Robust standard errors are reported.

Table 7: Inherited Trust and CO_2 Emissions Per Capita in 1950 and 2010: with a 25-year lag

	Dependent variable: Log CO_2 Emissions Per Capita in 1950 and 2010				
	(1)	(2)	(3)	(4)	(5)
Inherited trust in 1950 and 2010	-1.494*	-2.192***	-1.865**	-2.659***	-2.704***
	(0.744)	(0.508)	(0.674)	(0.641)	(0.769)
Log income per capita	1.273***	1.263***	1.487***	1.298***	1.406***
	(0.212)	(0.258)	(0.202)	(0.243)	(0.311)
Share of manufacturing	0.014	0.023***	0.002	0.007	0.008
	(0.009)	(0.008)	(0.009)	(0.009)	(0.011)
Trade openness	-0.008**	-0.008***	-0.006	-0.004	-0.008*
	(0.004)	(0.003)	(0.004)	(0.003)	(0.004)
Log income per capita in 1900 and 1960	-0.608***				
	(0.156)				
Political institution		0.045***			
		(0.012)			
Primary school enrolment			0.019***		
			(0.004)		
Urbanization rate				0.051***	
				(0.011)	
Population density					0.004***
					(0.001)
Observations	52	50	52	52	50
R-squared	0.927	0.932	0.934	0.939	0.907
Country fixed effects	Yes	Yes	Yes	Yes	Yes

Notes: The dependent variable is log CO_2 emissions per capita in the source countries in 1950 and 2010, relative to Sweden. Data come from the Carbon Dioxide Information Analysis Center (CDIAC). Inherited trust of US immigrants is measured relative to the inherited trust of Swedish Americans for the period 1950 and 2010 and estimated from the GSS. Data on income per capita come from the Maddison database, share of manufacturing from B.R. Mitchell (2007), trade openness from the Penn World Table, the quality of political institutions from the Polity IV database, and urbanization and population density from the World Bank. Data on preschool enrolment and religion come from Lee and Lee (2016) and Robert Barro (2003), respectively. All controls are measured relative to Sweden. Robust standard errors are reported.

Figure 3: Correlation between inherited trust in 2010 and the Vulnerability Index

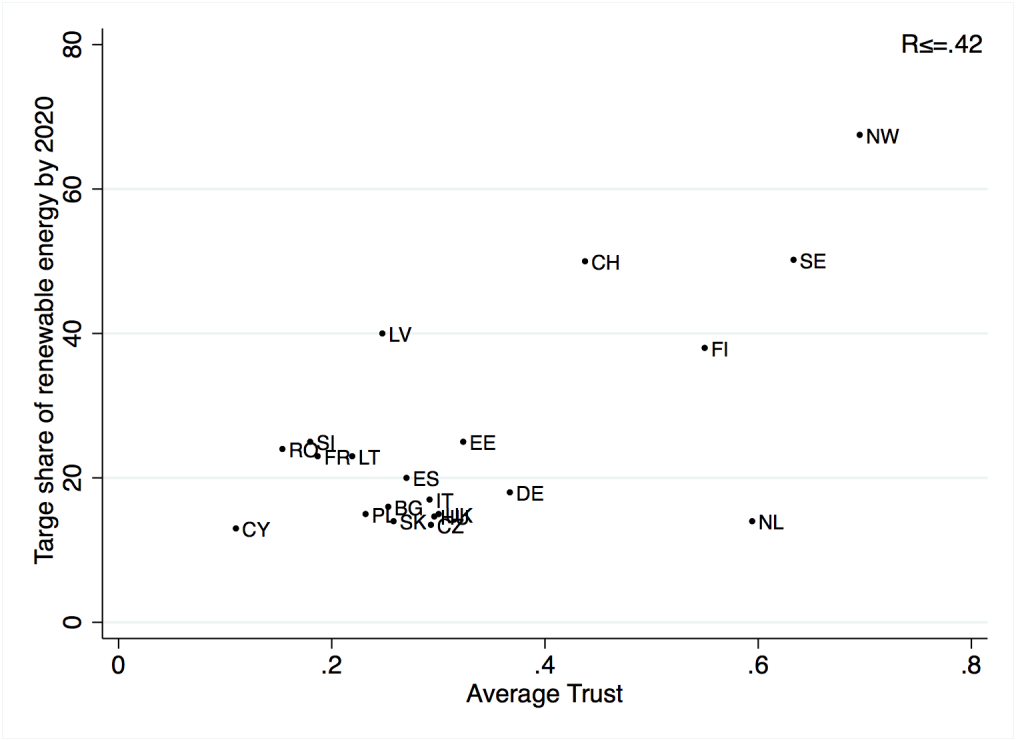


Sources: Chen et al. (2015) for the Vulnerability Index and GSS 1978-2014 for inherited trust.

Appendix

A1 Additional tables and figures

Figure A1: Correlation between Trust and Voluntary Renewable Energy Policy



Note: the graph plots the positive correlation between trust and the stringency of climate change regulations across countries measured by the target share of renewable energy in total energy consumption by 2020. The trust measure is constructed based on the World Value Survey (1984-2014).

Table A1: Observations for cohort 1950 and 2010: GSS 1978-2014

Country of origin	Cohort 1950	Cohort 2010
Africa	2,505	433
Austria	88	43
Belgium	36	16
Canada	216	119
Czechoslovakia	222	142
Denmark	175	37
Finland	86	37
France	491	109
Germany	4,385	921
Greece	29	81
Hungary	66	78
India	26	14
Ireland	3,216	731
Italy	809	869
Japan	20	38
Mexico	231	527
Netherlands	357	96
Norway	411	131
Poland	475	344
Portugal	44	44
Russian Federation	213	153
Spain	153	83
Sweden	376	128
Switzerland	108	22
United Kingdom	4,575	572
Yugoslavia	58	49

Table A2: Descriptive statistics: GSS 1978-2014

	Cohort 1950		Cohort 2010	
Variables	Mean	SD	Mean	SD
Age	49.87	17.07	35.84	13.84
Men	0.45	0.50	0.46	0.50
Education	13.31	2.91	13.86	2.59
Income	10.53	2.46	10.84	2.33
Employed	0.61	0.49	0.72	0.45
Unemployed	0.04	0.21	0.07	0.25
Protestant	0.65	0.48	0.35	0.48
Catholic	0.22	0.41	0.37	0.48

Table A3: Correlation between individual characteristics and trust

	Trust of immigrants
Age	0.009***
	(0.002)
Age squared	-0.000***
	(0.000)
Men	0.019***
	(0.006)
Education	0.037***
	(0.002)
Income	0.010***
	(0.002)
Catholic	0.013
	(0.027)
Protestant	0.001
	(0.009)
Employed	0.020
	(0.013)
Unemployed	-0.005
	(0.015)
Observations	15,730
R-squared	0.113

Notes: The dependent variable is trust of immigrants in cohort 2010 and 1950 and takes 1 if the respondent answered "Most people can be trusted" and takes 0 if the answer was either "Can't be too careful" or "Depends." This table reports the coefficients on the individual-level controls included in the regression presented in Table 1. Standard errors are clustered at the country level.

Source: General Social Survey: 1978-2014

Table A4: Correlation between trust of US descendants and trust in the country of origin: Sample decomposition by generation

	Dependent variables			
	Trust of cohort 2010 2nd 3rd generation	Trust of cohort 2010 4th generation	Trust of cohort 1950 2nd 3rd generation	Trust of cohort 1950 4th generation
	(1)	(2)	(3)	(4)
Trust in source country	0.379***	0.515**	0.360*	0.424
	(0.109)	(0.209)	(0.167)	(0.287)
Observations	2,359	1,109	2,139	10,123
R-squared	0.051	0.064	0.058	0.082

Notes: The dependent variables in (1) and (2) are trust of second-, third-generation immigrants and fourth-generation immigrants in cohort 2010, respectively. The dependent variables in (3) and (4) are trust of second-, third-generation immigrants and fourth-generation immigrants in cohort 1950, respectively. Trust in source country is the average level of trust in the country of origin of the immigrants in 2010. Standard errors are clustered at the country level.

Source: GSS 1978-2014, WVS 2010, ESS 2010.

Table A5: Descriptive statistics

VARIABLES	1950		2010	
	Mean	SD	Mean	SD
	(1)	(2)	(3)	(4)
CO_2 emissions per capita	3.56	3.05	7.67	3.17
GDP per capita	3,931	2,229	17,533	7,746
Openness to trade (%)	43.71	22.62	88.20	41.01
Share of manufacturing (%)	40.56	14.29	29.49	5.627

Notes: These are summary statistics of the original values of the variables separately for 1950 and 2010. In the regressions, the variables are transformed relative to Sweden by subtracting Sweden's values. The unit for CO_2 emissions per capita is metric ton of carbon dioxide per person. The unit for GDP per capita is 1990 International Geary-Khamis dollars.

A2 Alternative trust measures

The General Social Survey (GSS) provides data on immigrants' trust by the following question: "Generally speaking, would you say that most people can be trusted or that you need to be very careful in dealing with people?" and respondents answer the question by choosing one of the following options, "Most people can be trusted", "Can't be too careful," and "Depends." In the main text, we worked with a binary trust variable that takes 1 if the respondent answered that most people can be trusted and takes 0 if the answer was either of the other two options. In this section, we try alternative specifications to demonstrate that our results are not driven by our specification of the trust measure. We try three different approaches. First, we drop those who answered "Depends". Second, we group together those who answered "Most people can be trusted" or "Depends" and give them one, while those who answered "Can't be too careful" are assigned zero. Third, we try an ordinal measure that takes 3 for those who chose "Most people can be trusted", 2 for those who chose "Depends", and 1 for those who chose "Can't be too careful".

Table A6 reports the effects of inherited trust on the level of CO_2 emissions per capita when we use these alternative trust measures. For all specifications, the estimated effect of inherited trust is statistically significant. The magnitude of the coefficients are highly comparable with the one reported in the main section.

Table A6: Robustness checks for the trust measures: Inherited trust and CO_2 emissions per capita in 1950 and 2010 with a 25-year lag

	Dependent variable:		
	Log CO_2 Emissions Per Capita in 1950 and 2010		
	(1)	(2)	(3)
Inherited trust in 1950 and 2010	-2.749**	-3.380**	-1.530**
	(1.221)	(1.247)	(0.615)
Observations	52	52	52
R-squared	0.892	0.900	0.896
Country fixed effects	Yes	Yes	Yes

Notes: The dependent variable in (1) drops those who answered "Depends". The dependent variable in (2) groups together those who answered "Most people can be trusted" or "Depends" and gives them one, while those who answered "Can't be too careful" are assigned zero. The dependent variable in (3) takes 3 for those who chose "Most people can be trusted", 2 for those who chose "Depends" and 1 for those who chose "Can't be too careful".