The London School of Economics and Political Science

Essays in Environmental and Cultural Economics

Ara Jo

May 2018

A thesis submitted to the London School of Economics for the degree of Doctor of Philosophy.

Declaration

I certify that the thesis I have presented for examination for the PhD degree of the London School of Economics and Political Science is solely my own work other than where I have clearly indicated otherwise.

I declare that my thesis consists of approximately 62,000 words.

Statement of conjoint work

I confirm that Chapter 1 was jointly co-authored with Stefano Carattini and I contributed 90% of this work.

Acknowledgements

I am indebted to Antoine Dechezleprêtre and Steve Gibbons for their immeasurable support and guidance. I also wish to thank Antony Millner, Simon Dietz, Stefania Lovo, Karlygash Kuralbayeva, Francois Çohen, Damien Dussaux for kindly and generously sharing with me their knowledge and experience as I struggled and progressed through my PhD.

Financial support from the Grantham Research Institute on Climate Change and the Environment and the Marshall Institute for Philanthropy and Social Entrepreneurship is gratefully acknowledged.

Finally, I thank my family and friends for their support and faith in me. All that I have accomplished in the past four years, I owe to you.

Abstract

This thesis approaches the global cooperation problem of climate change mitigation from a cultural standpoint. The research is inspired by the observation that voluntary efforts to reduce greenhouse gas emissions exist and more interestingly that there is heterogeneity in the level of voluntary action across countries. To what extent could this be explained by cultural differences? In Chapter 1, I argue the within-country culture of cooperation sustained by trust – the expectation that a random member of society is trustworthy – positively affects cooperative behavior in the international arena via reputation effects. I theoretically motivate this hypothesis and provide empirical evidence that countries associated with high trust have reduced greenhouse gas emissions more substantially than countries that display low levels of social trust. I further explore this line of argument in Chapter 2 by looking at how trust affects compliance. This chapter provides empirical evidence that trust facilitates firms' compliance decisions in an international climate change regulation (EU ETS), which makes enforcement less costly in high-trust countries. In Chapter 3, I turn my attention to potential determinants of trust. The paper focuses on the effect of migration on trust among neighbors in the context of Mexico. The findings suggest that migration negatively affects the formation of trust between individuals due to the expected short-term nature of the relationship.

Contents

Introduction **1**

1 Trust and CO_2 Emissions: Cooperation on a Global Scale **4**

1.1 Introduction . . . 4
1.2 Conceptual Framework . . . 8
1.2.1 Trust, Social Norms and Cooperation . . . 8
1.2.2 Trust and Cooperation in the Global Context . . . 12
1.3 Data Description . . . 16
1.4 Empirical Analysis . . . 17
1.4.1 Estimating the Role of Trust in Reducing CO_2 Emissions . . . 17
1.4.2 Inherited Trust of US Immigrants and Contemporary Trust in the Source Country . . . 19
1.4.2.1 Inherited Trust . . . 19
1.4.2.2 Correlation between Inherited Trust and Contemporary Trust in the Source Country . . . 21
1.4.3 The Role of Inherited Trust in Reducing CO_2 Emissions . . . 23
1.4.3.1 Baseline Estimation . . . 23
1.4.3.2 Placebo Test . . . 24
1.4.3.3 Discussion: local and global pollutants . . . 25
1.4.3.4 Counterfactual Analysis . . . 26
1.4.4 Robustness Checks . . . 27
1.4.4.1 With a 50-year Lag . . . 27
1.4.4.2 Different Periods: 1970-2010 . . . 28
1.4.4.3 Additional Controls . . . 29
1.5 Conclusion . . . 29

2 Trust, Compliance and International Regulation **43**

2.1 Introduction . . . 43
2.2 Motivating evidence . . . 47
2.2.1 Data . . . 47

2.2.2 Evidence . . . 48
2.3 Conceptual framework . . . 51
2.3.1 Internalized norms . . . 51
2.3.2 Social punishment for noncompliance . . . 52
2.4 Institutional background . . . 53
2.5 Data description . . . 55
2.5.1 Compliance in the EU ETS . . . 55
2.5.2 Measuring trust . . . 56
2.5.3 Firm-level controls . . . 58
2.6 Trust and compliance . . . 58
2.6.1 Using inherited trust as instruments . . . 58
2.6.2 Exploiting differences in the location of headquarters . . . 61
2.6.3 Robustness checks . . . 64
2.6.4 Extension: bilateral trust . . . 66
2.7 Conclusion . . . 67

3 The Effect of Internal Migration on Trust in Communities of Origin 79
3.1 Introduction . . . 79
3.2 Conceptual framework . . . 83
3.3 Data description . . . 85
3.3.1 Internal migration in Mexico between 2005 and 2010 . . . 85
3.3.2 Trust . . . 86
3.4 Identification strategy . . . 88
3.4.1 First-difference specification . . . 88
3.4.2 Developing an instrument for migration rates . . . 89
3.4.3 Constructing the instruments . . . 91
3.5 Trust and migration . . . 93
3.5.1 The impact of migration on trust . . . 93
3.5.2 Robustness checks . . . 95
3.5.3 Social relations and interactions as a mechanism . . . 96
3.5.4 Exploring heterogeneity . . . 97
3.5.5 Other aspects of local social capital . . . 98
3.6 Conclusion . . . 99

A Appendix to Chapter 1 108
A.1 Alternative trust measures . . . 108
A.2 Correlation between inherited trust and contemporaneous trust: alternative interpretations . . . 108
A.3 Further Data Description . . . 126

B Appendix to Chapter 2 **129**
B.1 Wealth as a competing factor? 129
B.2 Domestic demand for environmental regulation 130
B.3 Proofs 144
B.4 Further Data Description 146

C Appendix to Chapter 3 **154**
C.1 Net- and in-migration 156

Bibliography **159**

List of Tables

1.1 The Stage Game . . . 10
1.2 Cohort decomposition - example with a 25-year lag . . . 20
1.3 Inherited Trust in 1950 and 2010 . . . 31
1.4 Correlation between individual characteristics and trust . . . 32
1.5 Correlation between inherited trust of US descendants and trust in the country of origin . . . 33
1.6 Descriptive Statistics . . . 35
1.7 Inherited Trust and CO_2 Emissions Per Capita in 1950 and 2010: with a 25-year lag . . . 35
1.8 Placebo Test: Inherited Trust and CO_2 Emissions Per Capita in 1920 and 1980: with a 25-year lag . . . 36
1.9 Inherited Trust and CO_2 Emissions Per Capita in 1950 and 2010: with a 50-year lag . . . 39
1.10 Inherited Trust and CO_2 Emissions Per Capita in 1970 and 2010: with a 50-year lag . . . 40
1.11 Inherited Trust and CO_2 Emissions Per Capita in 1950 and 2010: with a 25-year lag . . . 41
1.12 Inherited Trust and CO_2 Emissions Per Capita in 1950 and 2010: with a 25-year lag Robustness checks for the trust measures . . . 42

2.1 Probit Estimation: Trust and Noncompliance in the EU ETS between 2005 and 2015 . . . 71
2.2 Distribution of Compliance Code, installation by year observations . . . 72
2.3 IV Probit Estimation: Trust and Noncompliance in the EU ETS between 2005 and 2015 . . . 75
2.4 Trust and Noncompliance in the EU ETS between 2005 and 2015: Exploiting the Differences in the Location of Headquarters . . . 76
2.5 Trust and Noncompliance in the EU ETS between 2005 and 2015: Robustness Checks . . . 77
2.6 Bilateral Trust and Noncompliance in the EU ETS between 2005 and 2015 78

3.1 Summary statistics . . . 103

3.2 Determinants of in- and out migration at the municipality level, 2005-2010 104
3.3 The effect of out-migration on trust: Mexico, 2005-2010 104
3.4 Robustness checks: the effect of out-migration on trust 105
3.5 Mechanism: the effect of out-migration on social relations and interactions 106
3.6 Heterogeneity: the effect of migration on trust 107
3.7 The effect of out-migration on other measures of social capital 107

A.1 Observations for Inherited Trust 1950 and 2010: GSS 1978-2014 111
A.2 Descriptive Statistics: GSS 1978-2014 111
A.3 European Countries Only: Correlation between inherited trust of US descendants and trust in the country of origin 112
A.4 Correlation between inherited trust of US descendants and trust in the country of origin: Sample decomposition by generation 113
A.5 Observations for Inherited Trust in 1920 and 1980 With 25 Years: GSS 1978-2014 113
A.6 Descriptive Statistics: GSS 1978-2014 114
A.7 Inherited Trust in 1920 and 1980: with a 25-year lag 115
A.8 Correlation between inherited trust of US descendants and trust in the country of origin: with a 25-year lag, 1920-1980 116
A.9 Observations for Inherited Trust in 1950 and 2010 with Lag 50 Years: GSS 1978-2014 117
A.10 Descriptive Statistics: GSS 1978-2014 117
A.11 Inherited Trust in 1950 and 2010: with a 50-year lag 118
A.12 Correlation between inherited trust of US descendants and trust in the country of origin: with a 50-year lag 119
A.13 Correlation between inherited trust of US descendants and trust in the country of origin: Sample decomposition by generation with a 50-year lag 120
A.14 Observations for Inherited Trust in 1970 and 2010 With Lag 50 Years: GSS 1978-2014 121
A.15 Descriptive Statistics: GSS 1978-2014 122
A.16 Inherited Trust in 1970 and 2010: with a 50-year lag 123
A.17 Correlation between inherited trust of US descendants and trust in the country of origin: with a 50-year lag, 1970-2010 124
A.18 Correlation between inherited trust of US descendants and trust in the country of origin: Sample decomposition by generation with a 50-year lag, 1970-2010 125

B.1 Descriptive Statistics: Firm-level Variables 134
B.2 Descriptive Statistics: Number of Second-generation Immigrants from Each Source Country 135

B.3 Trust and Noncompliance in the EU ETS between 2005 and 2015: Robustness Checks for Country-level Analysis . . . 137
B.4 Alternative Measure of Trust: Coefficients on the Country Dummies from the European Social Survey . . . 138
B.5 Alternative Measure of Trust: Coefficients on the Country Dummies from the World Value Survey . . . 139
B.6 Correlation between trust and measures of climate policy . . . 142
B.7 European Social Survey: Number of Respondents . . . 149
B.8 World Value Survey: Number of Respondents . . . 150
B.9 Number of Installations in the ETS by Country . . . 151
B.10 Descriptive Statistics: Country-level Variables . . . 152
B.11 Descriptive Statistics: Region-level Variables . . . 153

C.1 Descriptive statistics: social relations and interactions . . . 154
C.2 Heterogeneity: the effect of out-migration on other measures of social capital 155
C.3 First-stage regressions: relation between predicted and actual migration, 2005-2010 . . . 157
C.4 The effect of net- and in-migration on trust: Mexico, 2005-2010 . . . 158
C.5 First-stage regressions: with two endogenous variables . . . 158

List of Figures

1.1 Correlation between inherited trust of US immigrants and trust in their source country in 2010 - cohort 2010 . . . 34
1.2 Correlation between inherited trust of US immigrants and trust in their source country in 2010 - cohort 1950 . . . 34
1.3 Correlation between inherited trust in 2010 and outdoor air pollution measured by particulate matter (pm_{10}) . . . 37
1.4 Predicted variation in CO_2 emission per capita in 2010 if inherited trust had been the same as inherited trust in Sweden . . . 37
1.5 Correlation between inherited trust of US immigrants and trust in their source country in 2010 - cohort 2010 With a 50-year lag . . . 38

2.1 Correlation between Trust and Employment Protection Regulation . . . 69
2.2 Correlation between Trust and Renewable Energy Regulation . . . 70
2.3 Correlation between Trust and the Climate Laws, Institutions and Measures (CLIM) Index . . . 70
2.4 Correlation between Trust and Noncompliance Rate in the EU ETS . . . 71
2.5 Average Noncompliance Rate between 2005 and 2015 . . . 72
2.6 Noncompliance Rate by Year . . . 73
2.7 Average Trust . . . 73
2.8 Correlation between Trust in Source Country and Inherited Trust . . . 74

3.1 Migration rate at the municipality level, 2005-2010 . . . 101
3.2 Correlation between trust and out-migration rate at the municipality level 102

A.1 CO_2 Emissions in OECD countries: 1950-2010 . . . 110

B.1 Correlation between Trust and Regulation of Business Entry . . . 132
B.2 Correlation between Trust and the Environmental Policy Stringency (EPS) Index . . . 133
B.3 Distribution of Noncompliance Rates . . . 133
B.4 Noncompliance Rate between 2006 and 2015 (Excluding 2005) . . . 136
B.5 Correlation between Trust in Source Country and Inherited Trust with a 25-year Lag . . . 140

B.6 Global: Correlation between Trust in Source Country and Inherited Trust 140
B.7 Global: Correlation between Trust in Source Country and Inherited Trust with a 25-year Lag 141
B.8 Correlation between Trust and Demand for Environmental Regulations . 142
B.9 Correlation between Demand and the Stringency of Environmental Regulations 143

Introduction

The importance of culture has gained recognition in the economics literature. As a key cultural trait, trust – the expectation that a random member of society is trustworthy – has attracted particular attention from economists. Previous studies have documented the influence of trust on a variety of outcomes ranging from; economic growth (Knack and Keefer, 1997; La Porta et al., 1997; Zak and Knack, 2001; Tabellini, 2010; Algan and Cahuc, 2010), financial development (Guiso et al., 2004) to patterns of trade (Guiso et al., 2009). Furthermore, a number of papers have studied how trust affects the design of a wide variety of formal regulations (Algan and Cahuc, 2009; Aghion et al., 2010, 2011).

Can this growing literature also tell us something about the environment? In my thesis, I have attempted to apply the insights and methodologies developed in this literature to the field of environmental economics, which led to a number of new research questions. For instance, given the consensus that trust facilitates local cooperation, does it have implications for *global* cooperation problems such as climate change mitigation? Does trust affect the stringency of environmental regulations and if so, what are the specific mechanisms? This thesis sets out to rigorously address these questions.

In Chapter 1, jointly co-authored with Stefano Carattini, we argue that the within-country cooperative culture sustained by trust positively affects international cooperative behavior via reputation effects. We theoretically motivate this argument and then provide empirical evidence that an increase in trust leads to more global cooperation measured by larger reductions in CO_2 emissions over time in a macro-level regression with country fixed effects. The findings provide a plausible explanation for the existence of national and region-level mitigation efforts in the absence of a global agreement, which is difficult to reconcile with the conventional theory of collective action.

Chapter 2 explores the influence of trust on the design of climate change regulation by focusing on the role of trust in compliance at the firm level. The paper begins with the following observation: contrary to the existing literature that documents a negative relationship between trust and regulation (since trust shared among citizens reduces the demand for formal regulation), high-trust countries tend to be more stringent with their regulatory policies than low-trust countries when it comes to climate change regulation. I reconcile these two conflicting observations by focusing on the effect of trust on compliance. Specifically, I test if compliance is higher in high-trust countries, which allows their

governments to implement more stringent regulations that deal with global externalities given the same level of international pressure.

The European Union Emissions Trading Scheme (EU ETS) offers a unique opportunity to see whether installations located in different countries differ in their compliance patterns with respect to the same international regulation due to differences in trust and civicness. The findings reveal that noncompliance was significantly lower in high-trust countries. A distinguishing feature of the empirical design is that I later restrict my sample to installations owned by multinational firms (MNEs) and compare installations operating in the same geographical area but whose headquarters are located in different countries. This allows me to estimate the influence of trust prevalent in the country where the headquarters are located on compliance behavior of the firm's foreign affiliate, with country of operation fixed effects. This exercise yields robust findings that installations owned by firms headquartered in high-trust countries were more likely to comply with the regulation than those owned by MNEs based in low trust countries, even when they operate in the same country and therefore exposed to the same external environment.

To deepen our understanding in the formation of trust, I turn my attention to the determinants of trust in Chapter 3. The paper focuses on the effect of migration on trust among neighbors in the context of Mexico and tests the hypothesis that migration negatively affects the formation of trust due to the expected short-term nature of the relationship. I find empirical support for the hypothesis: residents in areas with high out-migration were more likely to adjust trust in their neighbors downward, pointing to the detrimental impact of migration on trust in origin areas.

These papers provide new insights into the role cultural traits play in environmental issues or more specifically, how local norms, such as trust, could affect global cooperation problems such as climate change. However, despite the growing evidence on the role of culture in economic activities, the question of specific workings of culture remains open. Guiso, Sapienza and Zingales (2015a) notes that this has been largely because (1) it is difficult to know where culture comes from, (2) it is sticky with rare drastic changes, and (3) even when these cultural changes occur they take place over a long period with many other things happening at the same time. They then suggest corporations as an alternative environment to study the role of culture. This is indeed a promising approach since with corporate culture, we know (1) when, how, and based on what values corporations are founded, (2) corporate culture is subject to more frequent changes (e.g., through hiring, firing and M&As), and (3) performance is more easily measured (Guiso et al., 2015a). There is an increasing interest in this line of reasoning that sheds light on specific mechanisms behind the documented effect of culture at the macro-level. For instance, Bloom et al. (2012b) provides evidence on the influence of trust in firms' decision to decentralize, which allows more efficient resource allocation within and across firms that leads to higher firm productivity and economic growth. This serves as microevidence for

the long-held belief that trust facilitates economic growth through lower transactions costs (Arrow, 1972). Similarly, I attempted to provide a plausible mechanism for the relationship between trust and climate change regulation by providing microevidence on the role of trust in compliance at the firm level in Chapter 2. I concur with Guiso et al. (2015a) that these approaches substantially enhance our understanding of how cultural norms affect economic behavior and relate to formal institutions. There are a number of interesting questions in this direction, for example, the evolution of preferences for environmental quality as a function of formal regulations, which I am pursuing in related work.

Chapter 1

Trust and CO_2 Emissions: Cooperation on a Global Scale

1.1 Introduction

As globalization accelerates, we are faced with an increasing number of global cooperation problems. Climate change is one example of such global collective action dilemmas on an unprecedented scale. The conventional collective action theory predicts that there should be no voluntary action since unilateral mitigation efforts impose costs while the benefits of climate change mitigation are dissipated across the globe. Yet, the reality is not as bleak. We do observe that a number of countries, regions and even individuals have taken independent action to reduce carbon emissions despite the absence of external enforcement. What is even more interesting is that there exists heterogeneity in the level of contribution across these voluntary actors —some are more active than others in their contribution to this global public good problem.[1] In this paper, we attempt to provide a plausible explanation for this puzzling phenomenon based on the microeconomic foundation on the relationship between trust, social norms and cooperation.

There seems to be a broad consensus that trust facilitates cooperative behavior in the presence of incomplete contracts and imperfect information (see, for example, Algan and Cahuc (2013)). However, what remains unanswered is to what extent, if at all, intra-group trust affects intergroup cooperation, or more generally, the scope of cooperation that could be sustained by such individual values and incentives. Tabellini (2008b) studies this question and observes that people who are trustworthy cooperate on a wider range of

[1]For instance, the European Union tends to be more active than the rest of the world in their efforts to tackle climate change with a target of 40 percent reduction in greenhouse gas emissions by 2030 compared with 1990 levels. We also see variation within Europe. Norway has made a pledge to achieve carbon neutrality by 2030, which is more ambitious than the Europe-wide goal of 80 to 95 reduction in emissions by 2050 while Sweden intends to reach the same target earlier by 2045. There is also growing empirical evidence for pro-environmental consumption behavior at the individual level (e.g. Welsch and Kühling (2009) among many others).

situations (e.g. via markets, institutions, etc.) than the untrustworthy who tend to cooperate only with a small set of people nearby (e.g. family members). In a different setting with reputation but no individual values such as trustworthiness, Dixit (2004) finds that incentives to maintain a good reputation are stronger with players located nearby, because they are more likely to be future partners and information about cheating can easily reach them. Unfortunately, the probability of cooperation goes to zero in both models as the distance between players goes to infinity. It makes them inappropriate for studying global cooperation, or why some people are willing to cooperate with foreigners who are located far away. This suggests that cooperation sustained only by individual incentives eventually gives way to institutions, as economies grow large and more globalized (Dixit, 2004). Thus, we provide a simple model that incorporates the role of social norms, an informal institution, in facilitating cooperation between trustworthy individuals and how it affects global cooperation via reputation effects. The model yields theoretical support for our hypothesis —individuals who live in a country where people trust and cooperate with each other, are more likely to cooperate with foreigners.

We then provide empirical evidence for the relationship between trust and global cooperation measured by the reduction in CO_2 emissions. Identifying the causal effect of trust faces a number of challenges. First, it is difficult to control for unobservable time-invariant national characteristics that could codetermine the level of trust and the level of emissions such as geography, legal origins and history due to the lack of long time-series data on trust across countries. A number of papers have dealt with this obstacle using time-invariant instruments such as religions (La Porta et al., 1997), ethnic fractionalization (Knack and Keefer, 1997) or historical literacy rates (Tabellini, 2010). One remaining concern related to this approach of using time-invariant instruments is that we are unsure whether the instruments picks up the effect of trust or some deeper influence of other time-invariant features related to trust on the level of emissions. A measure of trust with intertemporal variation could be one remedy. However, the difficulty is that cross-country data on trust only go back to the late 1980s, which does not provide meaningful time variation given the documented persistence of trust across generations (Rice and Feldman, 1997; Putnam, 2000; Guiso et al., 2009).

Second, even if we are able to include country fixed effects in our estimation, there remains another challenge in the identification, namely, time-varying omitted variable bias. There could be factors that affect trust and emissions simultaneously such as contemporaneous changes in the economic, political, cultural, and social environment of the country.

We rely on the methodology developed in Algan and Cahuc (2010) to deal with these identification issues. They provide a novel way to uncover the causal effect of trust (on economic development in their case) by focusing on the inherited component of trust and on its time variation over long time periods. Based on the evidence that trust is

highly persistent across generations (Rice and Feldman, 1997; Putnam, 2000; Guiso et al., 2009), they estimate trust held by previous generations by looking at the level of trust that US immigrants have inherited from their ancestors who came to America from different countries and at different points in time. Time variation in inherited trust thus comes from the ancestors' time of arrival in America, assuming that they brought with themselves the prevailing social norms and attitudes from their home countries at the time of their departure and passed them on to their descendants. To explain, they estimate the differences in trust between France and Germany, for example, by comparing Americans with ancestors who came to the US from France and Germany in similar periods, say, between 1950 and 1980. Running the same exercise for descendants whose ancestors came earlier, say, between 1920 and 1950, provides time variation in the inherited trust between the two source countries. A time-varying measure of inherited trust obtained by such logic serves as a proxy for trust held by people back in the source countries at the time periods that we look at. It allows us to include country fixed effects and control for unobservable time-invariant features that affect CO_2 emissions and trust at the same time such as geography (that is correlated with energy consumption patterns, fossil fuel endowments and potential damage from changing climate, etc) and history. The estimation of inherited trust is based on the General Social Survey that provides information on the contemporaneous trust of US descendants of immigrants, where their ancestors came from and the generation of the immigrants. The methodology provides credible information on the level of trust held by previous generations and thus allows tracing the evolution of trust for 26 countries around the world, including most European countries, Japan, India, Mexico and Africa.

This methodology can also help us reduce the concern stemming from time-varying factors by imposing a lag of minimum 25 years (one generation) between the time when trust was transmitted (that is, ancestors' time of arrival in America) and the contemporaneous level of CO_2 emissions in the source country. It is then less likely that the level of emissions and the level of trust held by people who left the source country at least 25 years ago were driven by some unobservable factors simultaneously. We control for a number of changes in the economic, political, cultural and social environment to further reduce the bias that may arise from other time-varying factors.

Our findings suggest that increase in inherited trust is a statistically significant factor that explains the reduction of CO_2 emissions over the period between 1950 and 2010, even when we include country fixed effects and control for the changes in economic growth, industrial composition, and trade patterns. The results are robust when we look at different periods such as 1970 and 2010 and include additional controls such as changes in political institutions, religious or social attitudes, education, urbanization, and population density. We also run a placebo test on the period between 1920 and 1980, which is an era when there was no awareness of man-made climate change, thus no reason for the relationship

between trust and CO_2 emissions to exist. As expected, we do not see the link between trust and CO_2 emissions between 1920 and 1980, while trust still had a positive impact on economic growth over the same period.

Our paper relates to two distinct strands of literature. First, it has grown out of the literature that concerns social norms and cooperation. In contrast to the conventional collective action theory, Ostrom (1990) documents a wide range of empirical evidence that local social norms —a set of shared beliefs on how one ought to behave in a given situation —enable individuals to cooperate to sustainably manage local natural resources in the absence of external enforcement. In fact, she observes that such self-governed resource management regimes often outperform formal enforcement regimes. One of the central characteristics of the cases of successful cooperation is trust between involved parties, or the capability of group members to gain a reputation for being trustworthy (Ostrom, 2000; Milinski et al., 2002; Poteete et al., 2010).[2] Taking this insight one step further, we show that the intragroup cooperative culture sustained by trust and trustworthiness may also affect intergroup cooperation through reputation effects.[3] We provide theoretical and empirical support for this hypothesis.

Also related is the well-established literature on the effect of trust, or social capital at large, on various economic outcomes. Most notably, a number of papers have documented the strong and positive influence of trust on economic development. Knack and Keefer (1997) and La Porta et al. (1997) provide early empirical evidence on the relationship between social capital and economic performance in a cross-country investigation. Zak and Knack (2001) provide theoretical support and further empirical evidence from a larger cross-sectional sample of countries. Recently, Tabellini (2010) and Algan and Cahuc (2010) corroborate the effects of trust on economic development controlling for country fixed effects. Trust has also been shown to affect financial development (Guiso et al., 2004), trade patterns (Guiso et al., 2009), and the design of institutions and regulations (Algan and Cahuc, 2009; Aghion et al., 2010, 2011). Closely related to the current article is Jo (2017) where the author provides support for our findings by showing that high-trust countries tend to have more stringent climate change legislation through lower enforcement costs.[4]

[2]Ostrom (2010) argues that this relationship between social norms and local cooperation could have implications for global collective action dilemma by generating multi-level externalities that go beyong the local level. Communities with solar power networks, better waste disposal facilities and efforts to reduce pollution levels in metropolitan areas are the examples put forward that help reduce local pollution levels as well as potentially decrease global greenhouse gas emissions. However, this argument has yet to be tested empirically. A recent paper by Brunel and Johnson (2017) provide empirical evidence against her argument.

[3]Carattini et al. (2015) also study the relationship between within-country trust and greenhouse gas emissions, but the paper fails to provide a compelling theoretical explanation for the observed relationship between the two variables. Also, the analysis provides correlational evidence only, relying on short-run variations in the average trust measure across countries between 1990 and 2007.

[4]We also draw insights for our theoretical framework from the repeated game with random matching literature. A group of papers investigate community enforcement mechanisms in this setting, where

The paper is organized as follows. Section 1.2 provides theoretical support for our hypothesis. We discuss the data in Section 1.3. Section 1.4 presents the estimation strategy and Section 1.5 discusses our findings and present the results from a placebo test and robustness checks. Section 1.6 concludes.

1.2 Conceptual Framework

In this section we present a simple model to theoretically motivate our hypothesis. We begin by discussing the relevant literature that provides insights for understanding the relationship between trust and cooperation. We then modify the standard model to incorporate the possibility of global cooperation to answer the following question —when people live in a society where people trust and cooperate with each other, are they also more likely to cooperate globally?

1.2.1 Trust, Social Norms and Cooperation

In his relation-based governance model, Dixit (2004) shows that cooperation is easier to sustain if the size of the group is small and individuals are close to each other. Given that information transmission is localized, incentives to maintain a reputation are stronger for individuals nearby since information about cheating is more likely to reach them than those who are located far away. Tabellini (2008b) also studies the range of situations in which individuals cooperate and reaches similar conclusions but in a different context. He observes that in reality, individuals draw utility from the act of cooperating itself (i.e., have "warm glow" preferences) and this non-pecuniary utility from cooperation is stronger among close individuals. In other words, there is no reputation, but norms of good conduct apply with greater force among close individuals.

Both models yield useful insight as to why we observe cooperation in various situations, but unfortunately the probability of cooperation being sustained goes to zero as the distance between individuals goes to infinity in both cases, thus inappropriate to explain why individuals cooperate *globally*. This indicates that cooperation sustained only by individual incentives eventually gives way to institutions as economies grow large and more globalized (Dixit, 2004). Thus, in this paper we focus on the role of social norms, a form of informal institution, in inducing global cooperation as one potential mechanism.

players change their opponents in each period and cheating against one opponent triggers sanctions by other members of the society (Okuno-Fujiwara and Postlewaite, 1995; Kandori, 1992; Ellison, 1994; Dal Bó, 2007; Takahashi, 2010). In particular, we focus on the setting of local information processing, first introduced by Okuno-Fujiwara and Postlewaite (1995) and also studied in Kandori (1992) and Dal Bó (2007), that provides players with information on the trustworthiness of the randomly matched opponent. Such information transmission structure serves as an interesting tool to investigate the incentives of the players to cooperate with foreigners whose trustworthiness is not provided by the local information processing system unlike that of local opponents.

The specification of desirable behavior together with sanction rules in a community constitutes a *social norm*. The role of such social norms in guiding human behavior in conflict situations has been studied in the repeated game literature with random matching (Okuno-Fujiwara and Postlewaite, 1995; Kandori, 1992; Ellison, 1994; Dal Bó, 2007; Takahashi, 2010). Among other factors, the literature is concerned about the minimal information transmission with which the cooperative social norm can be sustained and has shown that a large community can sustain cooperation through community enforcement under various levels of information availability.[5] We are particularly interested in the setting where players have access to some local information (as opposed to no or perfect information), although they do not observe what happens in the entire community; that is, players can observe the characteristics of their opponent to whom they are randomly matched in each stage game via their 'status', which we label as trustworthy or untrustworthy, and players make actions based on the status of their own and their opponent's.[6] We present a simple baseline model of such information structure used in the literature to illustrate the interaction between trustworthiness, norms and cooperation and more importantly, to motivate our extension of the model in the following section.

The structure of the repeated game with random matching is as follows. A society consists of a continuum of players on [0,1]. In each period t=1,2,..., a player is randomly matched to another player to play a two-player stage game. This procedure is repeated infinitely and each player's total payoff is the expected sum of her stage payoffs discounted by $\delta \in (0,1)$, which is common to all players. We assume that the probability distribution over potential opponents in each period is uniform and independent of the past history. The stage game that each pair of players plays at time t is shown in Table 1.1. The payoff g is taken to be positive with l non-negative so that each player has Defect as a dominant strategy in the stage game.

Apart from their own history, players have access to a local information processing system that gives them information on the status or type of their opponents. The system has the following structure: (1) a status $z_i(t) \in Z_i$ is assigned to player i at time t; (2) when player i and j meet at time t and take actions $(a_i(t), a_j(t))$, the update of their status follows a transition mapping $(z_i(t+1), z_j(t+1)) = \tau_{ij}\left(z_i(t), z_j(t), a_i(t), a_j(t)\right)$; (3) at time t, player i can only observe $(z_i(t), z_j(t))$. The processing of information is treated as exogenous and assumed to function honestly.

Now, let us consider a simple social norm that prescribes the behavior of each player,

[5]There can be three broad levels of information availability; perfect information where every player's past actions are publicly observable, limited information where players have some information of their randomly matched opponents' past actions, and no information where players only observe their own past history.

[6]Okuno-Fujiwara and Postlewaite (1995), Kandori (1992) and Dal Bo (2007) use more neutral words, 'good' instead of 'trustworthy' to describe the type of players who are expected to follow the social norm and thus cooperate and 'bad' instead of 'untrustworthy' to describe the type of players who are not expected to cooperate or have deviated from the norm.

	Cooperate	Defect
Cooperate	1,1	-l,1+g
Defect	1+g,-l	0,0

Table 1.1: The Stage Game

σ, as a function of her status and the status of the matched player when there are two status levels, trustworthy (T) and untrustworthy (U), i.e., $z_i = \{T, U\}$. The associated status transition mapping is also defined below.

$$\sigma_i(z_i, z_j) = \begin{cases} Cooperate & \text{if } (z_i, z_j) = (T, T) \\ Defect & \text{otherwise} \end{cases}$$

$$\tau_i(z_i, z_j, a_i) = \begin{cases} Trustworthy & \text{if } (z_i, z_j, a_i) = (T, T, C) \text{ or } (T, U, D) \\ Untrustworthy & \text{otherwise} \end{cases}$$

$$P_i(T) = 1 - r \text{ and } P_i(U) = r$$

We suppose there is a fixed share of trustworthy players in the population, $1 - r$, labelled so in the sense that they are expected to cooperate for a mutually beneficial outcome in a conflict situation such as the prisoner's dilemma by conforming to the social norm.[7] An immediate implication of the setting of an infinite population is that each player is of zero measure and hence no unilateral deviation from the social norm by a single player will alter the distribution, i.e., the status distribution is stationary. The setting of an infinite population and the resulting stationarity of status distribution is reasonable since the endogenous formation or dynamic change of status distribution, i.e., why there is higher trust or are more trustworthy individuals in some countries than in others, is beyond the scope of our analysis. We are mainly interested in the extent to which community enforcement is possible in the presence of local information processing system and its sustainability as a function of the trustworthiness of the population.

To explain the system above, the social standard behavior $\sigma_i(z_i, z_j)$ prescribes that a player cooperates if both she and her opponent are trustworthy and defects if either is untrustworthy. A player's status is revised according to τ_i. A player with trustworthy status remains so as long as she follows the social standard behavior but changes to untrustworthy if she deviates. Note that each player's decision making and the update of

[7]There is strong experimental evidence that suggests there are different types of individuals. There are 'conditional cooperators' who are willing to cooperate so long as other people also cooperate, while there are 'free riders' who never cooperate no matter what (Fischbacher et al., 2001; Fehr and Gächter, 2000b; Fehr and Schmidt, 1999; Ostrom, 2000). This structure of the model closely matches this evidence.

the status is done without the knowledge of the entire society. They are based only on the local information which consists of the player's status and her action and the status of the matched player.

It can be shown that with such social norm that facilitates cooperation between trustworthy individuals, any strictly individually rational payoff (cooperative outcome in this case) can be supported by a sequential equilibrium when the discount factor is sufficiently high.[8]

PROPOSITION 1 (i) The social norm, $\sigma_i(z_i, z_j)$, can be sustained as a sequential equilibrium if players are sufficiently patient or $\delta \in (\delta^*, 1)$ for some δ^*. (ii) Trustworthy players have greater incentives to conform to the norm if r is low.

Proof. The model we consider here is Example 1 of Okuno-Fujiwara and Postlewaite (1995) with a generic payoff matrix. Thus we closely follow their approach in proving the results. It is a player's best response to follow the norm if the immediate gain from deviation is less than the resulting loss in the future due to the change in one's status. The resulting loss is evaluated along the equilibrium path, or evaluated by the value function $v^{\infty}(z_i, {\sigma_i}^*)$. The immediate gain is g, while the present discounted payoff along the equilibrium path is $\frac{1-r}{1-\delta}$ and zero for trustworthy and untrustworthy players, respectively. Then the norm is sustained if:

$$\delta^* = \frac{g}{g + 1 - r} \leq \delta \tag{1.1}$$

For part b of the proposition, it is straightforward that δ^* is an increasing function of r. Q.E.D.

Intuitively, trustworthy players follow the norm if players are patient enough and sufficiently value future cooperation opportunities. In particular, the main implication of the equilibrium is that trustworthy players face greater incentives to follow the norm when there are a large number of trustworthy individuals in the community. The expected loss in future payoffs from deviation, of becoming untrustworthy and losing future cooperation opportunities, $\frac{1-r}{1-\delta}$, is higher or simply cheating is more costly as the share of trustworthy individuals in the community rises.

[8]The payoff to a player i is said to be *individually rational* if it is at least as large as the level she can guarantee for herself, i.e., $\underline{u}_i = \min_{a_j \in A} \max_{a_i \in A} g_i(a_i, a_j)$.

1.2.2 Trust and Cooperation in the Global Context

Now, suppose there is a global collective action dilemma that requires attention and collective effort of all societies (or countries) that constitute the global community. We model the situation by introducing to the population a number of foreigners whose status is 'unknown', which constitutes b percent of the population and b is assumed to be equal across countries. The local information processing structure is not able to provide information on the trustworthiness of foreigners (one can think of the barriers imposed by the difference in language, culture, appearance, etc. that could hinder the functioning of the local information system). The existing social norm then does not advise players on what to do upon being matched to a foreigner simply because their status is unknown (recall that the norm prescribes appropriate actions only based on the player's status and the status of the matched opponent). The question here is then, is the social norm still sustainable in the presence of foreigners? Do trustworthy individuals have incentives to cooperate with foreigners? We show that trustworthy individuals do cooperate with foreigners even when their trustworthiness is unknown and the incentives to do so increase in the fraction of trustworthy individuals in the local population.

PROPOSITION 2 (i) The norm $\sigma_i'(z_i, z_j)$ can be sustained as a sequential equilibrium in the presence of foreigners if players are sufficiently patient or $\delta \in (\delta^*, 1)$ for some δ^*. (ii) Trustworthy players have greater incentives to cooperate with foreigners when r is low.

Proof. Consider the norm $\sigma_i'(z_i, z_j)$ and the following modified status transition with the presence of foreigners.

$$\sigma_i'(z_i, z_j) = \begin{cases} Cooperate & \text{if } (z_i, z_j) = (T, T), (T, X) \\ Defect & \text{otherwise} \end{cases}$$

$$\tau_i(z_i, z_j, a_i, a_j) = \begin{cases} Trustworthy & \text{if } (z_i, z_j, a_i, a_j) = (T, T, C, \cdot), (T, U, D, \cdot), \\ & \qquad\qquad (T, X, C, \cdot) \text{ or } (T, X, D, D) \\ Untrustworthy & \text{otherwise} \end{cases}$$

where a_j is the opponent's action and X is the unknown status of foreigners. Players still play the same prisoner's dilemma game described in Table 1.1. The best response strategy can be expressed in terms of unimprovability as in Okuno-Fujiwara and Postlewaite (1995). That is, it is a player's best response to follow the norm if the immediate gain from defecting against a foreigner is less than the resulting loss in the future due to the change in one's status. The probability of the foreigner's cooperation, $\theta \in (0, 1)$, is assumed to be random for the sake of simplicity, i.e., $E(\theta) = \frac{1}{2}$. The resulting loss is

evaluated along the equilibrium path, or evaluated by the value function $v^{\infty}(z_i, {\sigma_i}^*)$. It is straightforward to check that the expected immediate gain from defecting against a foreigner is $\frac{1}{2(g+l)}$. The present discounted payoff for a player of each status along the equilibrium path is as follows.

$$ {v_i}^{\infty}(T) = \frac{1}{1-\delta}[(1-b)(1-r) + b(\frac{1}{2} - \frac{1}{2}l)] \tag{1.2} $$

$$ {v_i}^{\infty}(U) = \frac{b(1+g)}{2(1-\delta)} \tag{1.3} $$

The unimprovability requirement $1/2(g+l) \leq \delta[{v_i}^{\infty}(T) - {v_i}^{\infty}(U)]$, reduces to the following condition.

$$ \delta^* = \frac{g+l}{(1-b)[2(1-r)+(g+l)]} \leq \delta \tag{1.4} $$

Thus, for δ sufficiently large, the loss caused by the change in status is greater than the expected gain from a one-shot deviation against a foreigner, and therefore trustworthy players have incentives to cooperate with foreigners even when their status is unknown. For the second part of the proposition, it is clear that δ^* is an increasing function of r. A large fraction of trustworthy players in the population makes defection against foreigner costly and thus serves to lower the threshold discount factor beyond which the norm is sustained. Q.E.D.

The modified transition function is identical to the one in the previous section, so long as players are matched to local players whose trustworthiness is observable. For matchings with foreigners, if a trustworthy player cooperates she remains trustworthy irrespective of the foreigner's action, a_j. On the other hand, if she defects there are two possible outcomes. In the case where the foreigner defects as well, she remains trustworthy. We interpret this as the player's cautiousness being justified. If, however, the foreigner cooperates she becomes untrustworthy, which will cost her future cooperation opportunities that could have been ensured by remaining trustworthy (i.e. local trustworthy partners who follow the social norm do not cooperate with untrustworthy players).[9]

The equilibrium provides a simple theory of how local cooperative norms between trustworthy players create incentives to cooperate with foreigners through the role of reputation. The most important implication is that individuals face greater incentives to cooperate with foreigners when they live in a society with a large number of trustworthy

[9]We have assumed the same payoff structure for cooperation with foreigners (the same g and l). One might argue that the benefit from global cooperation might be smaller than local cooperation. Assuming $g' < g$, where g' is the benefit from global cooperation, in fact makes the incentive to cooperate with foreigners even stronger since ${v_i}^{\infty}(U)$ is smaller when g' is lower. Similarly, assuming $l' < l$, where l' is a loss from being cheated by a foreign partner, makes ${v_i}^{\infty}(T)$ larger. Intuitively, trustworthy players take the risk of being cheated by foreigners when they cooperate with them and thus a lower price of such risk-taking induces trustworthy players to be more inclined to cooperate with foreigners.

individuals. There is a greater benefit of having the reputation for being trustworthy when most people are trustworthy. The result relies on the status transition function that specifies, defection against cooperative foreigners is treated similarly as defection against local trustworthy players —trustworthy players become untrustworthy in both cases.

This specification is consistent with a growing body of experimental evidence that shows global cooperation can be sustained by local interaction and local punishment for global defection. For example, Milinski et al. (2006) run an experiment where players are first asked to contribute to a "climate fund" that will benefit the entire world and then play a 2-player prisoner's dilemma game (PD henceforth). 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 PD than when each contribution remained anonymous, which highlights the role of reputation that flows across local and global settings.[10]

A recent work by Hauser et al. (2016) provides further evidence on the interaction between local and global cooperation through reputation. In alternating rounds of public goods games (PGG henceforth) and PDs, they find that in a pairwise PD game with two neighbors, players were more likely to cooperate with neighbors who had contributed at least as much as themselves 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.[11] They also provide direct evidence that local punishment effectively induces global cooperation by showing that when both neighbors defected in the PD, the player significantly increases contribution in the following PGG.[12]

[10]In a more generic setting that replaces the contribution to the climate fund with standard multi-player public good games, Milinski et al. (2002) find that a higher level of cooperation is sustained in public good games (played among six players including the pair that will play the PD in the next round) when they are alternated with 2-player PDs than when all PGGs (Public Good Games) are played first and followed by a series of PDs. This reflects that not contributing in the PGG harms the reputation of a player in the following PD, which induces players to contribute in the PGGs. They provide evidence for this mechanism of reputation in two ways. Firstly, players are more likely to defect in a 2-player PD if their opponent did not contribute in the preceding PGG (that involved four other players apart from the pair themselves). In other words, players tend to withhold from cooperating with those who did not behave in a trustworthy manner in the preceding PGG. Secondly, they show that cooperation in the PGGs is sustained only when there is the risk of future rounds of PDs. In groups that were told that there would be no PDs, thus no channel of reputation effects, cooperation declined rapidly.

[11]Here the group sizes in PGGs are much bigger than usual with 39 players on average and 17 and 60 being minimum and maximum, respectively, compared to, for instance, 6 in Milinski et al. (2002). In a second experiment, they replicate their findings with a group of 1000 players for the PGGs and provide further evidence on the scalability of local-to-global reciprocity.

[12]We also observe similar punishment mechanisms in formal law enforcement. The exercise of extraterritorial jurisdiction, defined as the legal ability of a government to exercise authority beyond its normal boundaries, is an example similar in spirit in that global defection (or defection against a foreigner) is punished locally. For some types of crime, a crime committed abroad is prosecuted in the country of origin of the offender even if the crime may not be illegal in the country where the offence took place (Colangelo, 2014). Fraud, bribery, sexual offences against children, murder and manslaughter are the

Most closely related to our model is a recent work by Jordan et al. (2016) where they provide evidence that reputation concerns drive uncalculating cooperation. They introduce a novel two-stage incentivised economic game where in the first stage player A decides whether to pay a cost to benefit a recipient in a way either calculating or uncalculating and in the second stage player B (who is not involved in the first stage game) and player A play a trust game, with player B as the truster and player A as the trustee.[13] As in standard trust games, the amount sent by B to A reflects B's trust of A and the amount returned from A to B reflects A's trustworthiness. First, they find 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 for reputational benefits. Also, their findings show that uncalculating cooperation is indeed perceived as a signal for trustworthiness as player B tends to send more money when she observed that player A was uncalculating in the first stage. Finally, uncalculating cooperation as a signal for trustworthiness seems to be valid since player A who was uncalculating in the first stage did behave in a more trustworthy matter (returned more money to player B) in the second stage. In our model, trustworthy players who follow the social norm cooperate with foreigners without knowing their trustworthiness and bear the risk of being cheated (thus cooperate uncalculatingly) in order to keep their reputation for being trustworthy. This specification seems to be directly supported by this experimental evidence.

The parameters g and l in the prisoner's dilemma game reflect the quality of *formal* institutions that we consider exogenous.[14] Better external enforcement implies a smaller benefit of cheating and a smaller loss from being cheated. It is instructive to discuss the implications of these parameters on the equilibrium. The immediate gain from deviating from the social norm falls in both cases, with and without foreigners, as g falls. However, the gain from defecting against a foreigner, $\frac{1}{2}(g+l)$, depends on l as well as g, whereas it only depends on g without foreigners. This follows from imperfect information. As players do not observe the trustworthiness of their foreign opponents, they bear the risk of cooperating with a cheating foreigner in the equilibrium. A smaller l reduces the cost of being cheated, which increases the incentives to conform to the norm of cooperation instead of deviating from it.

The equilibrium we discussed here illustrates how trust or trustworthiness of the pop-

examples for which the court can exercise extraterritorial jurisdiction.

[13]The authors employ two approaches to operationalize uncalculating versus calculating decision-making. One is to provide a looking choice whereby player A can choose to look at the cost of helping the recipient before helping. Another approach is to measure the time player A spends before making the helping decision when the cost is revealed based on experimental evidence that quick cooperative choices are perceived to be more prosocial.

[14]Tabellini (2008b) studies how formal institutions and the share of trustworthy individuals (who cooperate on a wider range of situations than the untrustworthy) dynamically evolve through value transmissions from parents to children.

ulation sustains the norm of cooperation within the country, and how such norms create incentives to cooperate with foreigners. In the following sections, we provide empirical evidence for this theoretical prediction by estimating the role of trust on the reduction in CO_2 emissions.

1.3 Data Description

We rely on standard sources for historic emissions and macroeconomic data. CO_2 emissions data are from the Carbon Dioxide Information Analysis Center (CDIAC) and measured in thousand metric tons of carbon dioxide. We focus on the period 1950 - 2010 for which 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.[15]

To trace the evolution of trust in different countries we use the information on the trust of US immigrants and the country of origin of their ancestors provided by the General Social Survey (GSS) since 1978. Individual trust is measured by the following question commonly used in other surveys and in 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 takes 0 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 the Appendix A.1.

The country of origin of the respondents' ancestors is given by the following question: "From what countries or part of the world did your ancestors come?" Individuals can name up to three countries in order of preference and when more than one country is named, respondents are asked to specify one country to which they feel 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 A.1).

[15]Here we only discuss two major macro-level variables but subsequently we employ more. Data Appendix contains a detailed description of all macro-level variables used in the analysis.

We use the 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 (the way we do this will be explained in detail in the following section). Respondents are asked if they were born and how many of their parents and grandparents were born in the United States. 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 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 source countries, which is to be used 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 exactly the same as the one used in the GSS, which makes the variable comparable across these databases.[16] 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.

1.4 Empirical Analysis

1.4.1 Estimating the Role of Trust in Reducing CO_2 Emissions

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

$$Emissions_{ct} = \alpha_0 + \alpha_1 T_{ct} + \alpha_2 X_{ct} + F_c + F_t + \epsilon_{ct} \tag{1.5}$$

where $Emissions_{ct}$ is per capita CO_2 emissions in country c and time t. T_{ct} measures the average trust of individuals who live in country c and time t, conditional on a set of individual characteristics such as age, gender, education, income, employment status and religious affiliations. 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 that is likely to be correlated

[16] Although the wording of the question is identical, the scale given for 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 the highest level of trust) and the WVS offers only two options, "Most people can be trusted", "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 categorisation has little impact on the comparability of the two variables because as stated in the main text the fraction of respondents who choose "Depends" is minimal. For the ESS, we also construct a binary variable from the answer that takes 1 if the respondent chose a number larger than 5 and 0 otherwise.

with emissions through energy consumption patterns, fossil fuel endowments and potential damage from changing climate, and also initial economic development or historical institutional qualities that may have had influence on trust and characteristics of the economy. Finally, F_t 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 variation 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 the evolution of trust attitudes in individuals. Second, the correlation between the change in trust and the change 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 there might have been political or social events in a country that affected generalized trust or trustworthiness of the population and industrial activities that led to changes in CO_2 emissions at the same time.

To overcome these difficulties, we follow the methodology developed in Algan and Cahuc (2010). The authors suggest a novel 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 time periods. The key insight here is that trust tends to be persistent across generations and therefore parents' trust is a strong predictor of their children's trust. Based on this observation they trace the evolution of inherited trust from the trust that US immigrants have inherited 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, assuming they brought with themselves the prevailing social norms and attitudes from their home countries at the time of their departure. 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 on 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 on the inherited trust variable α_1 then reflects the correlation between inherited trust and contemporaneous CO_2 emissions.

The concern for time-varying omitted variable bias is reduced by the 25-year lag that we impose between the time at which trust was transmitted by immigrant ancestors (which is their time of arrival in the US) and contemporaneous CO_2 emissions in the home country. The lag structure effectively replaces $\hat{T_{ct}}$ with $\hat{T_{ct-25}}$. It is then less likely that the correlation between changes in inherited trust and changes in emissions is driven by changes in some unobservable factors that affected the two variables simultaneously, after controlling for a number of channels through which trust in the past may affect the contemporaneous level of emissions. The way we implement this strategy is explained at

length in the section below.

We consider the periods 1950-1952 and 2008-2010 (1950 and 2010 henceforth) in our baseline estimation. As Figure A.1 shows, the trend in CO_2 emissions has been relatively stable for most countries from 1950 onwards after a structural break due to World War 2 in most OECD countries. It is important to go sufficiently far back in time to allow a long gap for inherited trust to evolve; however, we are also aware that up to around 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.[17] We make a trade-off between going as far back as to 1950 and including an era when there was no prior to expect the relationship between trust and CO_2 emissions to exist. Later, we take advantage of the setting by running a placebo test on the period (1920-1980) in which we do not expect to observe the link between trust and emissions. As robustness checks, we also consider an alternative period (1970-2010) and find similar results as in the main analysis.

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

1.4.2.1 Inherited Trust

In this section we estimate the evolution of trust transmitted from the home country through US immigrants from the General Social Survey (GSS) following Algan and Cahuc (2010). We impose a lag of 25 years between the inherited trust and the contemporaneous level of CO_2 emissions. It implies that we study trust attitudes transmitted at least $T-25$ before 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 affected both emissions at T and trust transmitted at least 25 years before T.

We use the following mechanism to estimate inherited trust in 1950 and 2010. The information on the birth year of the respondents (who are descendants of US immigrants) and their immigrant generation is used to group them into two cohorts, 1950 cohort and 2010 cohort. The two cohorts differ in the timing of their ancestors' arrival in America

[17]The first World Climate Conference was held in Geneva in 1979, convened by the World Meteorological Organization (WMO) with the main focus of the meeting being global warming and how it could affect human activity. 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 fuel starting from the 80's. Since then the topic has become a major political issue in many developed countries with varying degrees of intensity since then. In 1988, the WMO and the United Nations Environment Programme (UNEP) created the Intergovernmental Panel on Climate Change (IPCC), whose initial task was to prepare a comprehensive review and recommendations with respect to the state of knowledge of the science of climate change; social and economic impact of climate change; possible response strategies. Thus we believe it is safe to assume that the period between 1920 and 1980 was void of the public's awareness for climate change.

Table 1.2: Cohort decomposition - example with a 25-year lag

Generation	Cohort 1950	Cohort 2010
2nd	born before 1925	Born 1925-1985
3rd	born before 1950	born after 1950
4th	born before 1975	born after 1975

from the source countries (before 1925 and between 1925 and 1985, respectively) and therefore the prevailing social norms and attitudes they are presumed to have inherited. The 25-year lag pushes back the latest time of arrival in the country by 25 years from the periods in which we are interested.

Table 1.2 describes the cohort decomposition by immigrant generation. One generation is assumed to be 25 years. Inherited trust in 1950 is then that of second-generation Americans born before 1925 (i.e. those whose parents 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 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 of fourth-generation Americans born after 1975. Table A.1 reports the number of observations for these two cohorts by their country of origin. Table A.2 presents summary statistics.

We run a single regression on both cohorts with interaction terms between cohort dummies and country of origin dummies, controlling for age, gender, education, employment status, religion, and income category in order to provide evidence for time variation in inherited trust. In another specification, we also try to include parents' education to address the possibility that trust is transmitted through parents' human capital rather than cultural transmission and find similar results. Table 1.3 reports the OLS estimates of inherited trust for 1950 and 2010 measured by the coefficients on the country of origin fixed effects. Trust inherited in 1950 by Swedish Americans is used as the reference group. We include year dummies to control for common temporal shocks. Standard errors are clustered at the country of origin level.

Column 1 presents the estimates for inherited trust in 1950 relative to trust inherited by Swedish Americans in 1950. The results suggest that having ancestors coming 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 to trust 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

to trust 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, Japan, and Africa.

Column 2 reports inherited trust in 2010 relative to trust inherited by Swedish Americans in 1950. The estimates suggest substantial time variation in inherited trust for most source countries. The pattern in the evolution of inherited trust we find here is remarkably similar to what Algan and Cahuc (2010) document in their paper although we consider a slightly different time period (their baseline period is 1935-2000). It provides further evidence for the persistent nature of trust and its slow evolutionary process. Swedish Americans have inherited higher trust in 2010 than in 1950. Similarly, trust inherited from other Nordic countries has also increased. In contrast, inherited trust deteriorated over time for most Continental European countries as well as Mediterranean countries such as Italy and Greece. We report the effect of other individual characteristics on trust in Table 1.4. Trust is positively correlated with age, education and income as documented by previous studies (Alesina and La Ferrara 2002; Glaeser, Laibson and Sacerdote 2002).

1.4.2.2 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 source countries. We would expect to find a strong correlation between inherited trust and current trust back in the source country, if the channel of cultural transmission within families is at work.

As in Algan and Cahuc (2010), we estimate the same regression that we ran above but replace the country of origin fixed effects by the current level of average trust in the source countries in 2010 provided by the World Value Survey and the European Social Survey. One might be concerned about 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 try to restrict the sample to respondents whose ancestors came from European countries and use the ESS only to calculate the current level of trust. The results are reported in Table A.3 and qualitatively consistent with what we find and discuss in this section.

Column 1 and 2 in Table 1.5 show the results for descendants of US immigrants who have inherited trust from their ancestors in 2010 and 1950, respectively. Column 1 indicates that for the period 2010, the level of average trust in the source 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 period 1950 (Column 2), but with larger standard errors. It indicates that the contemporaneous trust in the source country does not predict trust inherited much earlier (before 1925) as precisely as it predicted trust inherited more recently. This is consistent with the time variation in inherited trust we observed in the above section.

Another possible interpretation for the weaker correlation between inherited trust in 1950 and the contemporaneous trust in the source country in 2010 might be that the change in inherited trust over the period of 1950-2010 is driven by the selection of immigrants. People who migrated to America before World War 2 might have been systematically different from those who migrated after the war and transmitted a different set of social norms and values to their children. We attempt to investigate this possibility by checking if the inherited trust attitudes of one cohort can predict those of the other. If the observed time variation is driven by sample selection or if each cohort is simply a subsample of the population that is not representative of the population back in the source country, the attitudes of the two groups should be relatively different and not likely to be a strong predictor of each other's inherited trust. To investigate this, we estimate the same regression used in Column 1 and 2 but replace the current level of average trust in the source countries by the average inherited trust of the other cohort. In Column 3 and 4, we find that inherited trust of one cohort is a strong predictor of the inherited trust of the other cohort, which supports the interpretation based on the evolution of values and attitudes, rather than variation from sample selection.

Yet another alternative interpretation of time variation in inherited trust is that trust attitudes of immigrants in cohort 1950 have converged to those of Americans as the time spent in the host country since the transmission of the values increases. However, we have seen in Table 1.3 that there are statistically significant differences in inherited trust across countries of origin for immigrants in cohort 1950, which should have not been the case had there been a convergence in attitudes. We further explore this possibility in the Appendix and confirm that there has been little convergence by focusing on the fourth-generation immigrants in cohort 2010. Contemporaneous trust in the source country is still a statistically significant predictor of inherited trust of the fourth-generation immigrants in cohort 2010 (Table A.4).

Figure 1.1 and 1.2 visually show the relationship between the current trust in the source country in 2010 and the inherited trust of US immigrants for cohort 2010 and 1950, respectively. Inherited trust is measured by the coefficients on the country of origin fixed effects in the individual-level regression now run separately on each cohort. As we discussed, the correlation between trust in the source country in 2010 and trust inherited by US immigrants in 2010 is strong and positive (Figure 1.1). On the other hand, we find that the relationship between current trust in 2010 and inherited trust in 1950 is much weaker (Figure 1.2).

1.4.3 The Role of Inherited Trust in Reducing CO_2 Emissions

We are interested in discovering whether the culture of cooperation between trustworthy individuals within a country affects their willingness to cooperate in a global collective action dilemma, climate change. To shed light on this question, we investigate the effect of inherited trust on the reduction of CO_2 emissions.

1.4.3.1 Baseline Estimation

In this section we discuss the findings from our baseline estimation with country fixed effects. The dependent variable is log per capita CO_2 emissions relative to that of Sweden in 1950 and 2010. All other variables that we subsequently introduce are also measured relative to Sweden. Descriptive statistics for our dataset used in this section are shown in Table 1.6.[18] 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 1.7 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 three major components that can explain the level of per capita emissions: economic development and sectoral composition of the economy and trade patterns.[19] 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.[20] The historical data on 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).[21] An

[18] More detailed discussions on the data follow in the Data Appendix.

[19] Technology in pollution abatement is another key component extensively studied in the literature (Levinson, 2009). However, it is difficult to measure the level of technology across countries and we believe the GDP per capita measure will account for this component at least to some extent.

[20] The pollution haven hypothesis posits that regulatory stringency in developed countries shifts polluting industries to the developing world with lax environmental regulations. The debate on the hypothesis, regarding the complicated interaction between international trade, foreign investment and the environment, is still ongoing. Copeland and Taylor (2004) and Brunnemeir and Levinson (2004) provide careful reviews on the literature.

[21] One might be concerned about the uncertainty rising from the fact that we use estimated coefficients as a variable, although most of them are precisely estimated. We try to get a sense of this uncertainty by randomly drawing 1000 values from the distributions of the point estimates associated with fixed effects; in other words, we generate 1000 different versions of the inherited trust measure. Then we construct the empirical confidence interval by running 1000 regressions using each of these measures and we find that

alternative trust measure that controls for 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 taken as a whole and it might contaminate the result, but find the same result with significance at 5 percent level (Column 3). Excluding Nordic countries, in case these high-trust countries are driving the result, also does not affect the findings (Column 4).[22] We believe that the findings provide support for our hypothesis that the culture of cooperation between trustworthy individuals within a country positively affects global cooperative behavior.

1.4.3.2 Placebo Test

As mentioned earlier, the strategy of focusing on the inherited component of trust and going far back in time to allow enough time for inherited trust to evolve comes at a cost, in our context, of including an era when there was no awareness of man-made climate change. However, we turn it to our advantage by running a placebo test on the period when there is no prior to expect the relationship between trust and CO_2 emissions to exist. Data availability and the concern to proceed with enough observations lead us to consider the period between 1920 and 1980.

The way we estimate inherited trust for 1920 and 1980 is exactly the same as the way we proceeded in Section 1.4.2.1. 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 minimum 10 observations in the individual regressions on the trust question, which leaves us 19 countries. As 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 category. We report the number of observations and descriptive statistics for each cohort and country of origin in Table A.5 and A.6, respectively.

We report the results from this exercise in Table 1.8. When we move the time window to 1920-1980, the effect of inherited trust on the level of CO_2 emissions is now positive and statistically insignificant (Column 1). On the other hand, per capita GDP remains positive and statistically significant. This is intuitive since we would still expect the scale effect to be in place, while we hypothesize that the increase in trust would not affect

it does not include zero. Further, the variable is significant at 5 percent level close to 99% of the time.

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

the change in the level of emissions during this early time period because the concern for climate change had not emerged yet. Next, we try to replicate the findings in Algan and Cahuc (2010) on the effect of inherited trust on economic growth during this time period. Unlike the relationship between trust and CO_2 emissions, the documented effect of trust on economic growth is not contingent on specific time periods and thus we would still expect to see a positive effect of inherited trust on per capita GDP. Column 2 and 3 confirm this intuition. Indeed, the inherited trust variable is associated with a precisely estimated 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]

1.4.3.3 Discussion: local and global pollutants

Our baseline estimation suggests that high-trust countries reduced CO_2 emissions more substantially over the period under study than low-trust countries. As our theoretical model depicts and the placebo test supports, we interpret the results as evidence for higher willingness for global cooperation in high-trust societies. However, the potential cross-effects of pollution regulation —namely, the ancillary benefits of local pollution regulation on CO_2 emissions and the local co-benefits of climate change policies —suggest two alternative interpretations of our findings, which we discuss carefully below.

Firstly, 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 due to spillover effects or complementarity between local and global pollutants. Then the more substantial reductions in CO_2 emissions in high-trust countries we observe may merely be a byproduct of their successful local pollution regulations rather than their willingness to contribute to the global collective action dilemma. 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 for 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 outputs (which we control for by GDP per capita), rather than a complementarity between NO_x and CO_2. Brunel and Johnson (2017) expands the scope of the analysis to all manufacturing industries in the United States and find similar results. They exploit exogenous variation made available by changes in air quality standards under the Clean Air Act and compare counties that do not meet the new standards and therefore have to face more stringent regulation (non-attainment counties) and counties that meet the standards and faced no more stringent regulation than the

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

status quo (attainment counties). They find no evidence that local and global pollutants are complements —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.

Secondly, another alternative interpretation may be that high-trust countries face larger local co-benefits from climate change regulations. Unlike the effects of local pollution abatement on reducing global pollutants we discussed above, the effects of the opposite direction are well-documented (see Nemet et al. (2010) for a review of the literature). In this case, the larger reductions in CO_2 in those countries might reflect their attempt to realize perceived local benefits through climate policies rather than their contribution to the global collective action problem. However, it is not the case that trust and marginal benefits from local air pollution abatement are positively correlated. We observe the opposite in reality. Figure 1.3 shows that there is a negative correlation between the level of local air pollution and trust across countries. Given that the marginal benefit of pollution abatement increases in the level of pollution, it is clear that high-trust countries tend to be more cooperative in climate change mitigation efforts although they face smaller local benefits from climate change policies.

1.4.3.4 Counterfactual Analysis

The findings discussed so far indicate that inherited trust is a significant factor in explaining the change in the level of CO_2 emissions across countries. We quantify the effects of inherited trust in a counterfactual analysis where we present the change in CO_2 emissions in 2010 that countries would have had if the level of inherited trust had been the same as that of Sweden. The analysis is based on the estimates reported in Column 1 in Table 1.7 where we control for country fixed effects, per capita GDP, the share of manufacturing, and openness to trade. Figure 1.4 displays the results from this analysis. CO_2 emissions in 2010 would have been reduced by 45 percent in India, 41 percent in Africa and 29 percent in Mexico if the level of inherited trust had been the same as inherited trust from Sweden. Developing countries are often characterized by low interpersonal trust and the analysis here shows that these countries would have experienced substantial changes in their emission levels. The estimates suggest that having a higher level of trust would have led to a nonnegligible change in the level of emissions in more developed countries as well. CO_2 emissions would have been lower by 18 percent in France, 9 percent in Germany and 5 percent in the Netherlands if they had inherited the same level of trust as Sweden.

1.4.4 Robustness Checks

1.4.4.1 With a 50-year Lag

In our baseline estimation, we imposed the lag of 25 years, which is assumed to be one generation, between inherited trust and the level of emissions in order to address the concern of time-varying omitted variable bias. By doing so, we reduce the possibility that there exist some unobserved time-varying factors correlated with both the change in the level of emissions and the change in inherited trust, which was transmitted at least 25 years before the time when the emission levels are observed. As in Algan and Cahuc (2010), we attempt to further reduce this concern by increasing the lag between inherited trust and the level of emissions to two generations, at least 50 years. This makes it even less likely that there are unobserved time-varying components that simultaneously drive the change in the level of emissions and the change in inherited trust in the source country, which is now assumed to have been transmitted at least 50 years before the periods we study. To ensure we have enough observations, we include second-, third-, and fourth-generation immigrants with at least one parent born in the United States.

We update the cohort decomposition described in Section 1.4.2.1 using a 50-year lag. Now, 1950 cohort and 2010 cohort consist of descendants of US immigrants whose ancestors arrived in America before 1900 and between 1900 and 1960, respectively. Inherited trust in 1950 is then 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. We keep countries of origin with at least 10 observations in the individual regression on the trust question, which leaves us with 23 countries. Table A.9 and A.10 report the number of observations and descriptive statistics, respectively, for each cohort and country of origin.

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 category. We run separate regressions for 1950 and 2010 using Swedish Americans as the reference group in both periods. Figure 1.5 shows a strong correlation, even with the lag of two generations, between trust in the home country in 2010 and inherited trust of US immigrants for the period 2010. Table A.11 shows that even with a 50-year lag, there is substantial variation across countries of origin and over time. Table A.12 reports a strong correlation between inherited trust and current trust in the source countries even with a 50-year lag.

Table 1.9 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 the lag of 50 years. We include the same set of controls used above with country fixed effects. The results are qualitatively very similar to what we find in the baseline estimation.

1.4.4.2 Different Periods: 1970-2010

We also study different time 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 (because then we will be including more of the time when 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 used so far to estimate inherited trust for 1970 and 2010. We use the lag of 50 years that we believe is more exogenous and at the same time allows more observations.[24] 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. [25] The number of observation and summary statistics for each cohort are reported in Table A.14 and A.15, respectively. We are able to keep all 26 countries in our sample. Inherited trust is measured by the coefficients associated with country of origin fixed effects in the individual level regressions based on the GSS, controlling for age, gender, education, and income category. As reported in Table A.16, having ancestors coming from a different country than Sweden has a statistically significant effect on inherited trust for most countries of origin in these periods. Also, we find a strong correlation between inherited trust of US immigrants and current trust back in their source countries (Table A.17).

Table 1.10 presents the estimated effect of the change in inherited trust on the change 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

[24]The 50-year lag structure allows for more observations for the 2010 cohort in particular. This is because we have a large number of fourth-generation Americans and if we use the lag of 25 years almost all of them end up in cohort 1970 (born before 1995) and almost none of them in cohort 2010 (born after 1990). This is natural given the fact that the respondents are at least 18 years old at the time of interview and the newest round was conducted in 2014 (in actual fact there are only three 18-year-old respondents born after 1995 and interviewed in 2014).

[25]Although inherited trust in 2010 had been estimated earlier, it should be modified with respect to the new starting time period because the cohort decomposition requires that there should be no overlap in the two cohorts. For instance, in period 1950-2010 with a 50-year lag, cohort 2010 included second-generation Americans born after 1900 and before 1960. If we were to use the inherited trust estimated from this cohort in our alternative period 1970-2010, we would have had overlap in estimated inherited trust caused by second-generation Americans born between 1900 and before 1920 belonging to both cohorts.

along with country fixed effects. The findings are qualitatively very similar to what we find in the previous sections even when we look at different time periods. Inherited trust seems to be a significant factor in explaining the heterogeneity of the level of emissions across countries.

1.4.4.3 Additional Controls

We include additional controls to further check for omitted variable bias. Firstly, given the documented interplay between formal institutions and culture (Algan and Cahuc, 2009; Aghion et al., 2010, 2011), we control for the quality of political institutions that could be correlated with the level of trust and also affect emissions (through environmental policies, for example) using the Polity IV dataset. Secondly, it is plausible that other social attitudes that may affect willingness to cooperate globally might have coevolved with trust over the period we investigate. We deal with this possibility by explicitly controlling for religion and education. Data on the share of religious fractionalization comes from Barro (2003). We use the period 1970s and 2000s to explain the change in the level of emissions between 1950 and 2010 due to limited data availability.[26] For historical data on primary school enrolment, we rely on Lee and Lee (2016). Former Yugoslavia countries are missing in the dataset. We proceed with our baseline specification with the lag of 25 years between inherited trust and the emissions over the period 1950-2010. Finally, we try to control for urbanization rate and population density that are related to energy consumption patterns in a given country. The data on urbanization and population density comes from the World Bank.

Table 1.11 reports the results of the regressions that include these additional controls. In addition to our baseline controls, Column 1 adds the Polity 2 variable from the Polity IV dataset, Column 2 controls for primary school enrolment and Column 3 includes the measure of religious fractionalization. In Column 4 and 5, we add urbanization and population density measures, respectively. The effect of the change in inherited trust remains robust with the inclusion of these additional controls.

1.5 Conclusion

Given the long-standing literature on local social norms and cooperation, in this paper we have attempted to move one step forward by studying whether local social norms could have implications for *global* cooperation. More specifically, we were interested in the hypothesis that the within-country cooperative culture sustained by trust and trustworthiness of the population positively affects international cooperative behavior.

[26]The data are available only for three periods, 1900s, 1970s and 2000s.

To motivate the link between trust and global cooperation theoretically, we incorporate the role of social norms, a form of informal institutions. Existing theoretical work has shown that cooperation between players located far apart becomes difficult to sustain as the distance grows. It thus serves to illuminate the role of institutions as the size of the economy grows and more globalized. We build our model based on this insight and show that local social norms shared by trustworthy individuals create incentives, via reputation effects, for the trustworthy to cooperate with foreigners even when they are unsure of their trustworthiness. The most important implication of the equilibrium is that individuals face greater incentives to cooperate with foreigners when they live in a society with a large number of trustworthy individuals.

We find empirical evidence that supports this prediction. Based on the innovative methodology developed in Algan and Cahuc (2010), we estimate the effect of inherited trust on the reduction in CO_2 emissions and the findings suggest that countries that have experienced a larger increase in trust have reduced CO_2 emissions per capita more substantially. To test the robustness of the results, we impose a longer lag between the outcome and the time at which trust was transmitted (to further reduce the threat of time-varying omitted variable bias), check if the results hold even in a different time period and include a wide set of additional controls. Our findings appear to be stable across this set of further specifications.

This paper provides a plausible explanation for the existence of national, regional and local level mitigation efforts in the absence of a global agreement, which has been difficult to reconcile with the conventional theory of collective action. We also believe that our findings emphasize the importance of local norms that has been largely overlooked by economists in governing the global commons.

The question of specific mechanisms behind this reduced-form macro relationship remains open. A logical next step would be to investigate potential channels that give rise to this cross-country relationship between trust and CO_2 emissions at more micro levels such as firms or individuals.

Figures and Tables

Table 1.3: 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	-0.240	(0.005)	-0.170	(0.016)
Austria	0.092	(0.007)	-0.065	(0.007)
Belgium	0.250	(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)	0.150	(0.004)
Finland	0.009	(0.008)	0.016	(0.004)
France	0.006	(0.005)	-0.054	(0.009)
Germany	0.007	(0.002)	-0.007	(0.009)
Greece	0.110	(0.006)	-0.180	(0.005)
Hungary	0.080	(0.006)	-0.039	(0.005)
India	-0.190	(0.009)	-0.200	(0.015)
Ireland	-0.010	(0.005)	-0.003	(0.011)
Italy	-0.048	(0.012)	-0.091	(0.014)
Japan	-0.170	(0.008)	0.061	(0.007)
Mexico	0.007	(0.012)	-0.120	(0.014)
Netherlands	-0.059	(0.003)	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	(0.009)

Notes: The dependent variable is the level of trust inherited by US immigrants from the periods 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 1.4: Correlation between individual characteristics and trust

VARIABLES	Inherited trust
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 the level of trust inherited by US immigrants from the periods 1950 and 2010 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 1.3. Standard errors are clustered at the country level.

Source: General Social Survey: 1978-2014

Table 1.5: Correlation between inherited trust of US descendants and trust in the country of origin

	Dependent variables			
	Inherited trust in 2010 (1)	Inherited trust in 1950 (2)	Inherited trust in 2010 (3)	Inherited trust in 1950 (4)
Trust in source country	0.370***	0.432**		
	(0.099)	(0.182)		
Inherited trust in 1950			0.692***	
			(0.080)	
Inherited trust in 2010				0.753***
				(0.093)
Age	0.004***	0.003***	0.004***	0.003***
	(0.001)	(0.000)	(0.001)	(0.000)
Men	0.049*	0.014**	0.052*	0.013*
	(0.025)	(0.007)	(0.025)	(0.006)
Eduation	0.029***	0.036***	0.028***	0.035***
	(0.002)	(0.002)	(0.003)	(0.002)
Income	0.004	0.009***	0.003	0.008***
	(0.003)	(0.001)	(0.003)	(0.001)
Unemployed	-0.046	0.006	-0.040	0.007
	(0.031)	(0.023)	(0.029)	(0.023)
Employed	0.021	0.029**	0.024	0.032***
	(0.033)	(0.011)	(0.033)	(0.011)
Catholic	0.004	0.070***	0.004	0.064***
	(0.030)	(0.025)	(0.026)	(0.023)
Protestant	0.015	0.015	0.036**	0.028***
	(0.022)	(0.015)	(0.018)	(0.009)
Constant	-0.397***	-0.520***	-0.548***	-0.593***
	(0.050)	(0.069)	(0.048)	(0.026)
Observations	3,468	12,262	3,468	12,262
R-squared	0.065	0.084	0.068	0.093

Notes: The dependent variables in (1) and (3) are the level of trust inherited in 2010. The dependent variables in (2) and (4) are the level of trust inherited in 1950. Trust in source country is the average level of trust in the country of origin of the immigrants in 2010. Inherited trust in 1950 is the average level of trust of immigrants in cohort 1950. Inherited trust in 2010 is the average level of trust of immigrants in cohort 2010. Standard errors are clustered at the country level.

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

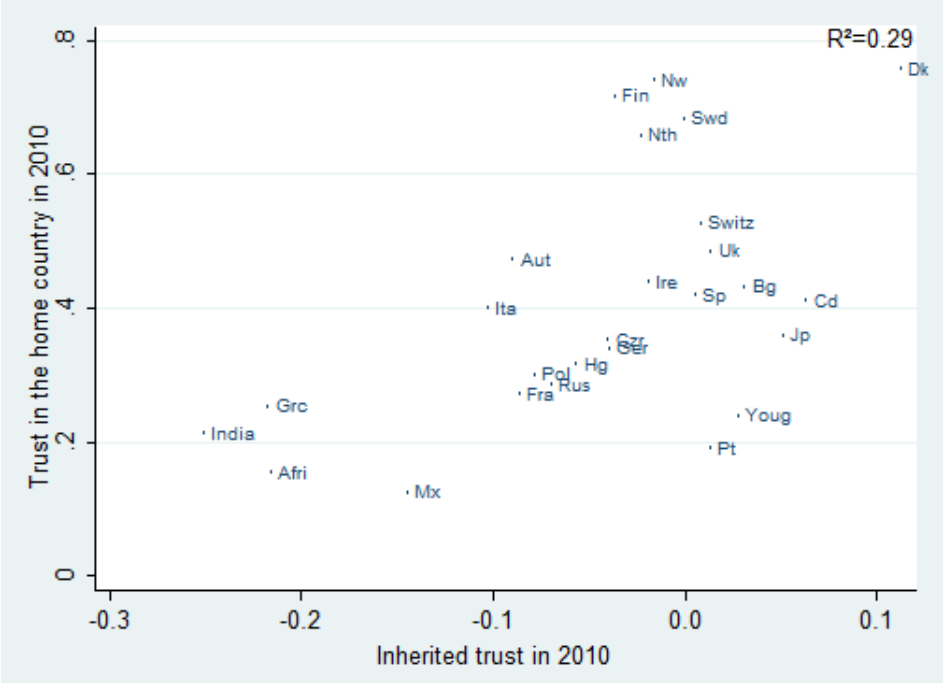


Figure 1.1: Correlation between inherited trust of US immigrants and trust in their source country in 2010 - cohort 2010

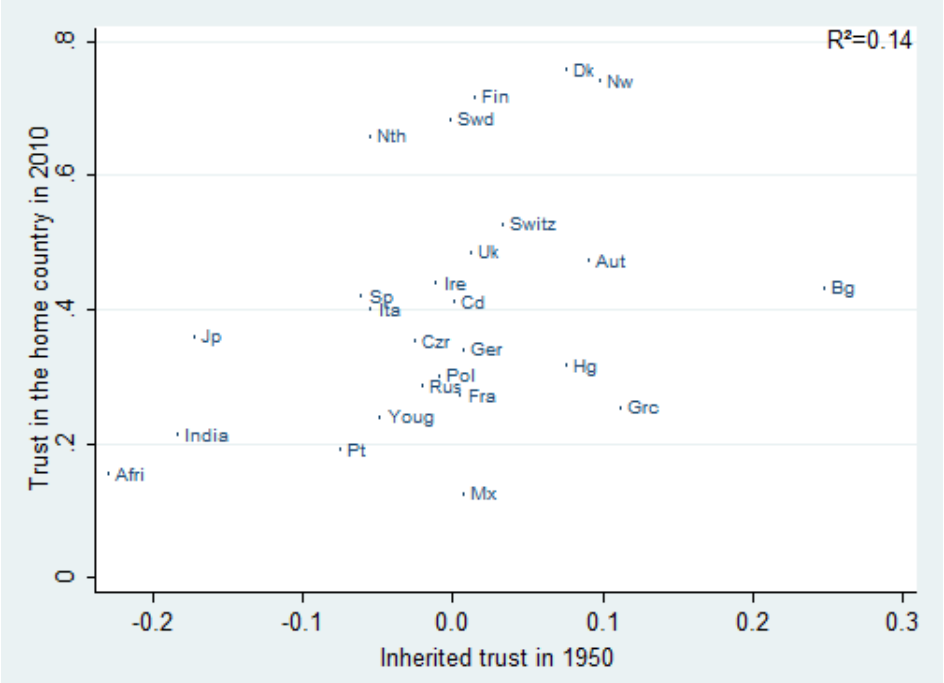


Figure 1.2: Correlation between inherited trust of US immigrants and trust in their source country in 2010 - cohort 1950

Table 1.6: 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.

Table 1.7: 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)
Inherited trust in 1950 and 2010	-2.548**	-2.529**	-2.403**	-2.629**
	(1.140)	(1.168)	(1.072)	(1.230)
Log income per capita	1.581***	1.542***	1.772***	1.535***
	(0.314)	(0.319)	(0.310)	(0.328)
Share of manufacturing	0.011	0.010	0.005	0.012
	(0.010)	(0.010)	(0.009)	(0.010)
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 periods 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.

Table 1.8: Placebo 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**
	(2.649)	(5,730.379)	(5,141.116)
Log income per capita	1.443*		
	(0.751)		
Initial income per capita		3.259***	2.436***
		(0.733)	(0.729)
Polity 2			258.002**
			(106.746)
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 periods 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.

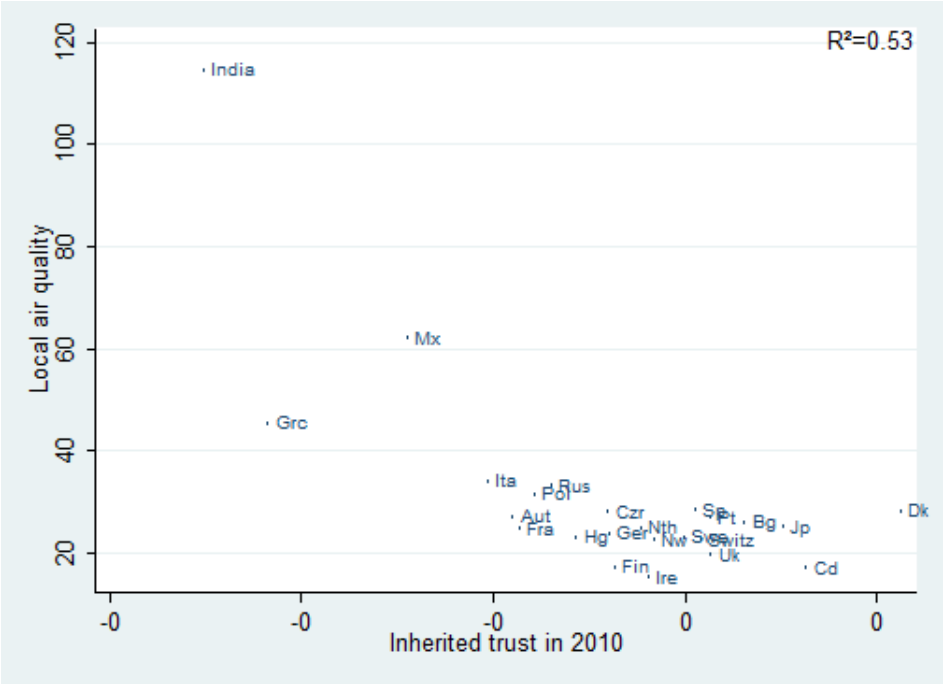


Figure 1.3: Correlation between inherited trust in 2010 and outdoor air pollution measured by particulate matter (pm_{10})

Sources: World Health Organization (2011) for average particulate matter (PM10) from urban centers and GSS 1978-2014 for inherited trust.

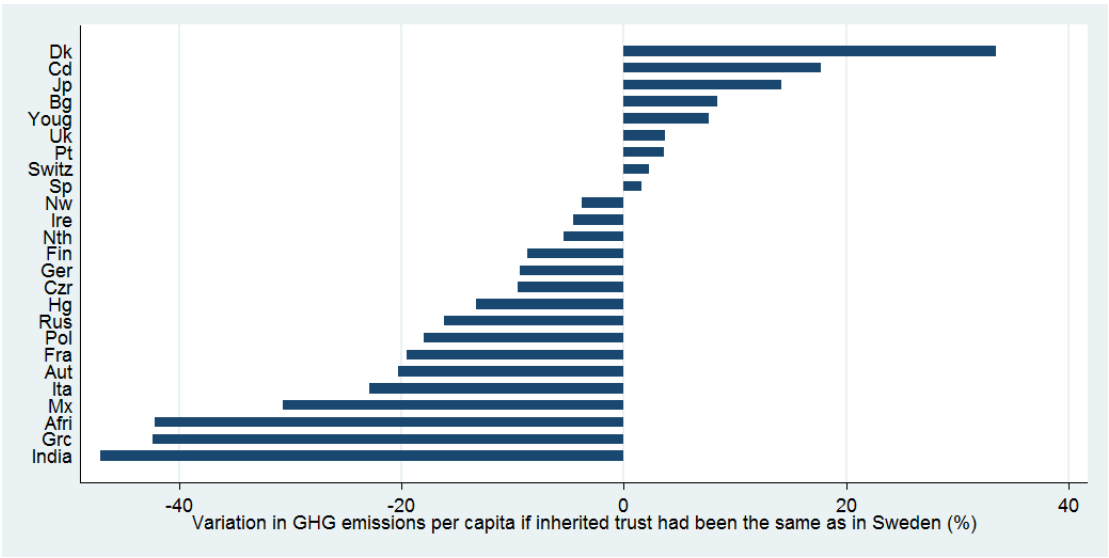


Figure 1.4: Predicted variation in CO_2 emission per capita in 2010 if inherited trust had been the same as inherited trust in Sweden

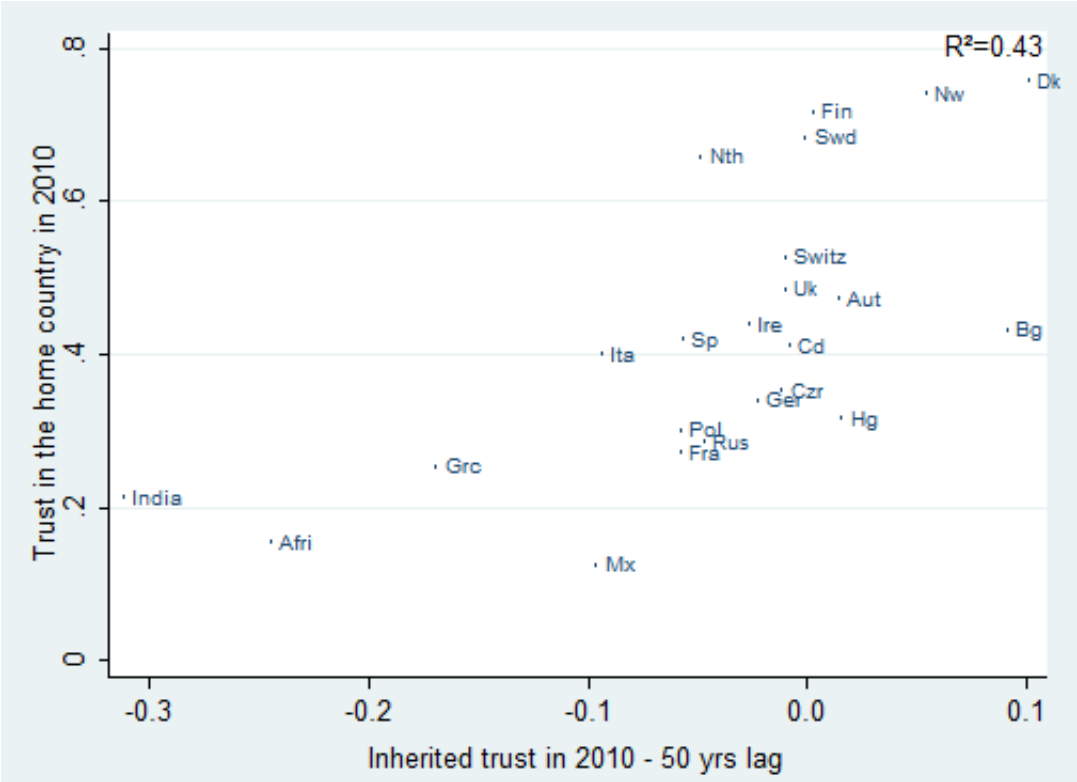


Figure 1.5: Correlation between inherited trust of US immigrants and trust in their source country in 2010 - cohort 2010
With a 50-year lag

Table 1.9: 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**
	(1.093)	(1.168)	(1.082)	(1.107)
Log income per capita	1.187**	1.298***	1.144**	1.261***
	(0.438)	(0.453)	(0.434)	(0.442)
Share of manufacturing			0.012	0.010
			(0.010)	(0.010)
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 periods 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.

Table 1.10: 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*
	(1.545)	(1.467)	(1.417)	(1.235)
Log income per capita	1.564**	1.388**	1.765***	1.846***
	(0.649)	(0.647)	(0.581)	(0.506)
Share of manufacturing			-0.022**	-0.021***
			(0.008)	(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 periods 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.

Table 1.11: 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	-2.192**	-1.865*	-2.293**	-2.659***	-2.704**
	(0.963)	(0.967)	(0.911)	(0.874)	(1.162)
Log income per capita	1.263***	1.487***	1.597***	1.298***	1.406***
	(0.281)	(0.258)	(0.251)	(0.250)	(0.321)
Share of manufacturing	0.023**	0.002	0.018**	0.007	0.008
	(0.009)	(0.009)	(0.008)	(0.007)	(0.009)
Trade openness	-0.008**	-0.006	-0.006*	-0.004	-0.008*
	(0.004)	(0.004)	(0.004)	(0.004)	(0.004)
Political institution	0.045***				
	(0.014)				
Primary school enrolment		0.019***			
		(0.006)			
Religious fractionalisation			5.776***		
			(1.532)		
Urbanization rate				0.051***	
				(0.012)	
Population density					0.004*
					(0.002)
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 periods 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.

Table 1.12: Inherited Trust and CO_2 Emissions Per Capita in 1950 and 2010: with a 25-year lag
Robustness checks for the trust measures

	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".

Chapter 2

Trust, Compliance and International Regulation

2.1 Introduction

The importance of generalized trust – the expectation that a random member of society is trustworthy – in economic outcomes has gained recognition in the literature. In particular, a number of papers have studied the influence of trust in the design of formal institutions and demonstrated that the stringency of a wide range of state regulations can be explained by average trust in a cross-section of countries. They have emphasized a strong negative relationship between trust and government regulation in the context of business entry and labor market regulations (Algan and Cahuc, 2009; Aghion et al., 2010, 2011).

With climate change legislation, however, we observe the opposite: there is a *positive* correlation between the stringency of regulatory policies addressing climate change and the average level of trust. Countries associated with high trust (northern European countries, for instance) tend to have higher CO_2 emissions reduction targets, require larger shares of energy consumption to come from renewable sources, and were the first to introduce carbon tax schemes.[1] Indices that measure the stringency of climate change policies across countries provide further support for this relationship.

In this article, I attempt to reconcile these two conflicting observations by focusing on the role of trust in compliance at the micro level. Trust or trustworthiness may positively affect compliance decisions through strong internalized norms or strong social punishment for non-cooperative behavior in high-trust societies. It is then plausible that higher compliance in high-trust countries might have induced their governments to implement

[1]For example, Norway and Sweden have climate change legislation that requires themselves to achieve carbon neutrality by 2030 and by 2045, respectively. This is markedly stringent given the collective goal of 80 percent reduction in CO_2 emissions in the European Union by 2050. In contrast, related policies in several countries fall short in their ambition and stringency to contribute to this collective target. France and Greece (relatively low-trust countries) aim to reduce their emissions 75 percent and 60 to 70 percent by 2050, respectively (Nachmany et al., 2016).

more stringent regulations that address global externalities such as climate change, particularly when there is a binding international goal to be reached as in the case of the European Union. Indeed, the potential differences in enforcement costs across countries are starting to be recognized. A recent policy report published by the European Commission documents that there is substantial variation in the cost of implementing EU-wide environmental laws across member states, some of which are directly measured and also others that are "difficult to quantify, but nevertheless real (Farmer et al., 2015)." My analysis in this paper adds support to their conclusion by providing empirical evidence on a potential source of different enforcement costs across countries associated with the differences in trust and civicness of their population.

I study how trust affects compliance decisions in the context of the European Union Emissions Trading Scheme (EU ETS): the world's largest carbon trading market operating in 31 countries (all 28 EU countries plus Iceland, Liechtenstein and Norway). This setting offers a number of advantages. First, it provides an ideal environment in which the same legislation is implemented in multiple countries, thus allowing me to investigate the systematic differences in compliance behavior caused by cultural traits such as trust, which largely varies at the country level.[2] Relatedly, the penalty for noncompliance is set at the EU level. This feature substantially reduces the problem of differential levels of stringency in formal enforcement. Finally, the European Union Transaction Log (EUTL), a system harmonized at the EU level, provides detailed installation level compliance data comparable across countries. Existing papers that studied compliance decisions of firms have used data on a single industry or several industries in a single country (e.g. Gray and Deily, 1996; Shimshack and Ward, 2005, 2008; Dasgupta et al., 2000; Nyborg and Telle, 2006; Duflo et al., 2014; Evans, 2016). I address this lacuna by taking advantage of this unique international dataset that contains over 16,000 installations operating in 31 different countries.

Identifying the role of trust in compliance is confounded by the task of having to disentangle the effect of legal enforcement from the role of trust. Although the stringency of formal enforcement is harmonized at the EU level, it is likely that country-specific regulatory environment or institutional capacity is correlated with how the rules are enforced in each country. Given that previous studies have documented a strong influence of trust on the design of institutions and regulations (Algan and Cahuc, 2009; Aghion et al., 2010, 2011), it is then likely that trust picks up the effect of formal institutions on compliance, rather than trust per se. It is also possible that there exist unobservable national features correlated with trust and compliance in the EU ETS simultaneously such as geography or past efforts to reduce emissions.

[2]Some papers have also exploited within-country variation in trust. For instance, Guiso et al. (2004) study the effect of trust on financial development in Italy, a country known for its substantial cultural variation across regions. Tabellini (2010) also exploit regional variation in trust across 8 large European countries.

I attempt to circumvent this difficulty with two approaches. First, I instrument the average level of trust in each country with trust inherited by second-generation immigrants whose parents came from these countries. Given the evidence that trust is highly persistent across generations (Rice and Feldman, 1997; Putnam, 2000; Guiso et al., 2006), inherited trust observed in second-generation immigrants is expected to be correlated with the level of trust in their countries of origin where their parents came from, and yet unlikely to directly affect compliance behavior of firms operating in their source countries since they are born and reside in their adopted countries. This measure of inherited trust helps isolate the role of trust from other country-specific factors that may affect compliance. Second, I look within countries and exploit the fact that a large share of the installations are operated by multinational subsidiaries. A number of papers have documented the influence of the source-country characteristics in MNEs' operation abroad (Bloom and Van Reenen, 2007; Burstein et al., 2009; Bloom et al., 2012b). Based on this insight, I investigate if trust in the country where the multinational is headquartered has influence on compliance decision in the affiliate's foreign location. This specification allows me to include country of operation fixed effects, which removes any bias associated with unobservable national characteristics that may be spuriously correlated with trust and compliance. I then investigate whether MNEs operating in the same country, thus exposed to the same external environment, differ in their compliance behavior due to the level of trust prevalent in their source countries.

Consistent with the main prediction of the conceptual framework, I find that trust prevalent in the country where the installation is located has a strong positive influence on its compliance decision. This finding is robust to including a full set of year and industry dummies, country-level controls and also firm-level characteristics that may affect compliance decisions. Second, exploiting the differences in the location of global headquarters of MNEs reveals that installations owned by firms headquartered in high-trust countries are more likely to comply with the regulation than installations owned by firms based in low-trust countries, even when they operate in the same geographic area (country as well as region): for example, in Germany, an installation operated by a multinational firm headquartered in Norway (a high-trust country) would be more likely to be in compliance with the EU ETS than an installation owned by another firm whose global headquarters are located in Greece (a low-trust country). The magnitude of the estimated effect is economically meaningful: a change in ownership from a multinational firm based in the lowest-trust country in my sample (Philippines) to another MNE headquartered in the highest-trust country (Norway) would be associated with a 1.5 percentage point decrease in the probability of noncompliance when the average noncompliance rate is 3.2 percent. This effect is comparable to the previous estimates for the effectiveness of traditional formal enforcement measures.

These findings have two interesting implications. First, the results imply that local

norms, such as trust, could play a significant role in global cooperation problems such as climate change. In this article, I argue that trust may affect the design of climate change legislation through its positive influence on compliance. Second, despite the growing evidence on the effect of culture on economic outcomes, understanding the mechanisms at the micro level has not been straightforward. As a remedy, Guiso et al. (2015a) argue that corporations and corporate culture offer economists a chance to develop a deeper insight into the specific workings of culture and how it relates to formal institutions. The strong firm-level empirical evidence regarding the effect of trust on compliance behavior documented in this paper adds support to this insight of using corporations as a laboratory in which to study the role of culture.

This paper contributes to several distinct strands of literature. First, it is related to the well-established literature on the effect of trust, or social capital at large, on various economic outcomes. Previous studies have documented that trust affects economic growth (Knack and Keefer, 1997; La Porta et al., 1997; Zak and Knack, 2001; Tabellini, 2010; Algan and Cahuc, 2010), financial development (Guiso et al., 2004), patterns of trade (Guiso et al., 2009) and global cooperative behavior (Carattini and Jo, 2017). Furthermore, trust has been shown to have a strong influence on the design of institutions and regulations (Tabellini, 2008a; Algan and Cahuc, 2009; Aghion et al., 2010, 2011). Despite the growing evidence for the importance of trust at the macro level, mechanisms that drive the observed cross-country relationships are not fully understood. I contribute to this literature by providing the first microevidence on the effect of trust on compliance behavior at the firm level.

Also related is the literature that investigates enforcement and compliance of environmental regulations. A number of papers have documented strong deterrent effects of formal enforcement actions (Gray and Deily, 1996; Deily and Gray, 2007; Shimshack and Ward, 2005, 2008; Dasgupta et al., 2000; Nyborg and Telle, 2006; Telle, 2013; Duflo et al., 2014).[3] Reecently, Evans (2016) has also shown the effectiveness of information-based enforcement tools on compliance using the Clean Air Act (CAA) watch list. On the other hand, Decker and Pope (2005) and Arguedas and Rousseau (2012) provide evidence for strategic complementarities between firms' compliance decisions whereby increased compliance by one firm diverts the regulator's attention to its rivals, which in turn increases the rival firms' compliance. My paper differs from the existing literature as I study compliance behavior in an international environmental regulation – the EU ETS – and show that the culture of generalized trust could also play a significant role in compliance decisions by exploiting country-level variation in trust in two ways: first, the variation in the location of installations and second, the variation in the location of the firm (that

[3]While focusing on the impact of formal enforcement measures on compliance, Gray and Deily (1996) and Deily and Gray (2007) also point out the influence of corporate culture or firms' 'unobserved propensity to comply' on compliance behavior.

operates the installation)' global headquarters.

Finally, this paper is related to the literature on the transmission of culture by individuals across countries. This literature provides evidence that a wide range of economic decisions such as fertility, labor market participation (Fernández and Fogli, 2006, 2009) or living arrangements (Giuliano, 2007) of second-generation immigrants living in the US are strongly predicted by the practice in their source countries. Another interesting example is provided by Fisman and Miguel (2007). They show that corruptive behavior of diplomats (measured by unpaid parking fines) stationed in the same city is predicted by the level of corruption in their home countries. Closely related to my analysis here is Bloom et al. (2012b) where they provide empirical evidence that supports this line of argument at the *firm* level. They find that trust in the country where multinational firms are headquartered has a strong positive correlation with decentralization in the affiliate's foreign plants, even when the managers in the plants are hired locally. I add to this literature by providing firm-level evidence that trust in the country where firms are headquartered has a strong positive influence on the compliance decisions of their installations even when they operate in a foreign country.

The article is organized as follows. In Section 2.2, I provide some motivating evidence on the correlation between trust and compliance behavior. Section 2.3 presents a simple conceptual framework. Section 2.4 provides background information for the setting and Section 2.5 describes data used for the analysis in detail. Section 2.6 presents the empirical analysis and Section 2.7 concludes.

2.2 Motivating evidence

In this section, I provide motivating evidence that gives rise to the hypothesis put forward in this paper. I begin by documenting a positive cross-country relationship between trust and the stringency of climate change regulation, which stands in contrast to the hitherto documented negative relationship between trust and other regulations. As a potential explanation, I focus on the role of trust in compliance and show that compliance is substantially higher in high-trust countries from micro-level regressions.

2.2.1 Data

I build trust measures using the European Social Survey (ESS). I pool data from the seven waves collected so far (from 2002 to 2014), which includes all European countries that participate in the EU ETS. The ESS measures generalized trust – the expectation that a random member of the society is trustworthy – by asking the classical 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' answers are given on a scale of 0 to 10,

where 0 implies "You can't be too careful" and 10 means "Most people can be trusted". The variable that I use in the econometric regression is the average of this answer within the country where the installation is located.

To compare different patterns of correlation between trust and regulation depending on the type of regulation, I use the stringency of regulation of product and labor markets commonly studied in the literature (Algan and Cahuc, 2009; Aghion et al., 2010; Alesina et al., 2015) and that of climate change regulations. The OECD indicator of the stringency of job protection over temporary and regular contract provides a measure for the stringency of labor market regulation that is comparable across countries.

The nationally determined, legally binding target share of renewable energy in gross final energy consumption by 2020 is used to reflect the stringency of climate change policies in EU countries. These targets, which are part of the National Renewable Energy Action Plan, are voluntarily chosen (not assigned) under the Renewable Energy Directive (2009/28/EC) that constitutes an important part of climate change legislation at the EU level. I also use the Climate Laws, Institutions and Measures (CLIM) Index, a globally comparative index that measures the stringency of climate change legislation developed by the European Bank of Reconstruction and Development (EBRD, 2011).

To look at the relationship between trust and compliance, I turn to the European Union Emissions Trading Scheme (EU ETS). Data on compliance in this international regulation between 2005 and 2015 comes from the European Union Transaction Log (EUTL), a system harmonized at the EU level that publishes information on compliance status, permit allocation, verified emissions and surrendered allowances at the installation level. I will save detailed descriptions of this key data for a later section.

2.2.2 Evidence

Figure 2.1 depicts what has been documented in the literature – a negative cross-country relationship between trust and domestic regulation of labor markets (measured by the stringency of employment protection legislation). High-trust countries such as Nordic countries as well as the United Kingdom tend to impose fewer restrictions on employers' hiring and firing decisions, whereas relatively low-trust countries such as Eastern European and Mediterranean countries tend to impose strict regulations. The correlation holds for a wide range of standard indicators for other regulations such as product market regulations as shown in Figure B.1.[4]

[Figure 2.1]

On the other hand, Figure 2.2 shows a positive correlation between trust and the stringency of climate change legislation measured by the percentage of renewable energy

[4]The data of Djankov et al. (2002) on the number of steps that an entrepreneur must complete before opening a business proxies the stringency of regulation of product market entry.

in gross final energy consumption by 2020. High-trust countries (again such as Nordic countries and Switzerland in this graph) tend to require larger shares of their energy consumption to come from renewable sources than other countries. The stringency of this regulation in these countries (for instance, 67.5 percent in Norway and 50 percent in Sweden and Switzerland) is noteworthy especially given that the EU wide collective target is set at 20 percent. The correlation is statistically significant at the 1 percent level even after controlling for the log per capita GDP and the share of population with tertiary education (EBRD, 2011).[5] Similarly, composite indices such as the Climate Laws, Institutions and Measures (CLIM) Index in Figure 2.3 and the Environmental Policy Stringency (EPS) Index in Figure B.2 are also positively correlated with trust across countries.

[Figure 2.2, 2.3]

How can we explain this puzzle? To begin, I note that regulations previously studied in the literature are domestic regulations whose impact lies within the boundary of their nations and primarily deal with local (or within counties) demand. Their negative relationships with trust arise since trust tends to be associated with low public demand for state regulation. Regarding the stringency of labor market regulations, for example, Algan and Cahuc (2009) argue that governments in high-trust countries tend to insure their workers against unemployment through more generous unemployment benefits due to lower threats of moral hazard (i.e. workers are less likely to cheat on government benefits). It then leads to lower public demand for employment protection regulation in those countries. Similarly, Aghion et al. (2010) show that distrust creates public demand for business regulations since individuals prefer government regulation to unbridled economic activity by corrupt and uncivic entrepreneurs.[6] However, climate change regulation addresses *global* externalities and as such, there exists demand that applies to all relevant countries at the international level. This is particularly true when there is a collective goal to be reached through cooperation of multiple countries as in the case of the European

[5]It is reassuring that the correlation remains strong even when I control for a measure of national wealth because richer economies tend to be significantly more active in climate change mitigation and also given the documented relationship between trust and wealth across countries (e.g. Algan and Cahuc, 2010). To further support my argument that trust could matter (independently or in addition to the country's wealth) via lower enforcement costs when countries are voluntarily choosing their own policies to contribute to joint objectives, I contrast this correlation with another case using an *assigned* policy measure in Section B.1 in Appendix B. As expected, the correlation between trust and this involuntary measure of climate policy disappears once I control for wealth (Table B.6).

[6]Additional evidence for the importance of demand in explaining the stringency of regulation is provided by Alesina et al. (2015) where they demonstrate that strong family ties and the resulting immobility of workers give rise to stronger public demand for more stringent labor market regulations so that firms are less able to extract rents from their workers' immobility. They find empirical evidence that individuals with strong family ties are more likely to demand labor regulation and accordingly, there exists a strong positive relationship between family ties and labor market regulations across countries.

Union.[7]

It is then plausible that trust may affect the way governments deal with this international pressure through its positive influence on compliance. Governments that anticipate higher compliance due to trust and civic virtue shared among their citizens and therefore face lower enforcement costs may implement more stringent regulations in order to ensure that the collective goal is reached.[8] Despite the seemingly contradictory macro-level correlation, this conjecture suggests that the mechanism is in fact consistent with the previous studies in that trust affects institutional outcomes through how law-abiding people are (Tabellini, 2008a).

To investigate the effect of trust on compliance as a potential channel, I check if there is any pattern in the relationship between trust and compliance in the EU ETS. This unique international regulation allows comparing compliance behavior across countries with respect to the same regulation. Figure 2.4 illustrates that there is indeed a negative correlation between trust and noncompliance rates across countries. While some countries are close to full compliance, other countries such as Bulgaria, Italy and Slovakia (relatively low-trust countries according to several international social surveys) display very high noncompliance, over or close to 10 percent.

[Figure 2.4]

Micro-level regressions in Table 2.1 confirm the negative correlation between trust and noncompliance. I begin by regressing the binary noncompliance variable that takes 1 if the installation is noncompliant and 0 otherwise against the trust measure of the country where the installation is located, without any controls (column (1) of Table 2.1). Standard errors are clustered at the country level. The correlation between noncompliance and trust is negative and highly significant – a 1 standard deviation increase in trust (0.95) from the mean is associated with a 1.6 percentage point decrease in the probability of noncompliance. Column (2) shows that the inclusion of year dummies and a full set of industry dummies hardly affects the correlation. To deal with the concern that trust might simply reflect higher levels of economic development (Algan and Cahuc, 2010;

[7]Unlike demand for regulation that deals with business markets and wages, public demand for environmental regulation does not appear to be correlated with trust across countries, which also explains why the public demand channel emphasized in the previous papers is not at play in my context. I use the International Social Survey Programme (ISSP) data to document the weak association between demand for environmental regulation and trust in Section B.2 in Appendix B. This aspect, together with the presence of international demand, points to the supply side dynamics of climate change regulations such as enforcement costs.

[8]One might argue that high-trust countries should also have more stringent regulations for other domestic economic activities if they face lower enforcement costs. However, as explained before, previous studies tend to emphasize the importance of demand in explaining the heterogeneity in the stringency of regulations rather than supply costs with domestic regulations. Furthermore, Aghion et al. (2011, 2010) show that formal regulations may disrupt the formation of civic virtues such as trust and cooperativeness (i.e. crowding out), which suggests another reason why governments in high-trust countries may be cautious about implementing more regulations than demanded.

Tabellini, 2010; Zak and Knack, 2001; Knack and Keefer, 1997) or educational attainment (Tabellini, 2010; Alesina and La Ferrara, 2002), column (3) includes log gross domestic product (GDP) per capita, percentage of population with tertiary education, and log population.

[Table 2.1]

In column (4), I also include governance indicators developed by the World Bank in an attempt to control for the effect of formal law enforcement or institutional capacity on compliance. These are country-wide 'rule of law' and the perceived regulatory quality.[9] The correlation between trust and noncompliance, however, seems to exist independently over and above these institutional factors.

In column (5), I include firm-level controls in order to isolate the role of trust in the country where the installation operates, from firm-specific characteristics that could affect compliance decisions. I control for the number of installations each firm operates as well as several key financial variables such as the number of employees, operating revenue and total assets. The financial data comes from Bureau Van Dijk's Orbis Database (which I will discuss more in Section 2.5.3) and the descriptive statistics of firms in each country is reported in Table B.1 in Appendix B. The coefficient in column (5) shows that the correlation between trust and noncompliance remains strong even when firm-specific variables are controlled for. In column (6) I try a logit model and find similar results.

Overall, this casual inspection provides suggestive evidence for the role of trust in compliance behavior of regulated firms, which warrants a more rigorous investigation.

2.3 Conceptual framework

In this section I discuss two main mechanisms for the association between trust and compliance based on the existing literature. I then focus on the common prediction of both theories that higher levels of generalized trust positively affect compliance.

2.3.1 Internalized norms

Sociologists have documented that individuals in high-trust societies tend to have strong internalized norms: they donate to charity, obey traffic rules, and pay taxes because they

[9]The precise definitions of these indicators are given in Kaufmann et al. (2011). Rule of law captures "perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence". Regulatory quality measures "perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development".

feel obligated to do so (Portes, 1998). In a similar spirit, trust shared in an area may positively affect compliance in environmental regulation.

The growing literature on corporate culture suggests such internalized norms are also present at the firm level. Most firms have clearly defined corporate culture – principles and values that should inform the behavior of all the firm's employees (Guiso et al., 2015b).[10] It is then likely that these self-declared values are influenced by internalized norms of the individuals who form the organizations and those of the region where they operate.

In parallel to the literature on the transmission of culture by immigrants that emphasizes the strength and persistence of internalized norms (Fernández and Fogli, 2006, 2009; Giuliano, 2007), there is a growing interest in the influence of source-country characteristics in multinational firms' operation abroad. For instance, Bloom et al. (2012b) provide empirical evidence that firms in high-trust areas tend to be more decentralized since trust facilitates delegation of decision making power from the CEO to managers. More interestingly, they find that trust in the country where multinational firms are headquartered has a strong positive correlation with decentralization in the affiliate's foreign plants, even when the managers in the plants are hired locally. This finding suggests that firms also take some of their home country culture abroad and emphasizes the strong presence of internalized corporate culture within firms. Thus, I expect trust in the country where firms operate to be positively correlated with their compliance behavior and to potentially affect their foreign subsidiaries' compliance decisions through shared corporate culture.

2.3.2 Social punishment for noncompliance

Alternatively, assuming that social sanctions for noncompliance are stronger when compliance rate is higher, trust may affect compliance decisions of firms through a high expected compliance rate in society. In reality, the 'name-and-shame' sanction in the EU ETS whereby member states "ensure publication of the names of operators and aircraft operators who are in breach of requirements to surrender sufficient allowances" (Article 16(2) of the Directive 2003/87/EC, henceforth the Directive), clearly embodies the threat of social punishment for noncompliance.[11]

I provide a simple analytical model of firms' pollution behavior in the presence of regulation to formalize this reasoning.[12] Let firm i with emission intensity (or simply type) $\theta_i \in [0,1]$ choose an action $b_i \in [0,1]$ when there is a regulation $L \in [0,1]$ that

[10] Guiso et al. (2015b) report that when they looked at companies' web pages, they found that 85% of the Standard and Poor's 500 (S&P 500) companies had a section dedicated to corporate culture.

[11] Several papers have already noted social motivations behind compliance decisions such as reputation, shame and guilt arising from not being in line with the behavior of other firms (Posner and Rasmusen, 1999; Banerjee and Shogren, 2010; Qin and Shogren, 2015).

[12] The set-up is adopted from Acemoglu and Jackson (2017) where they study the role of social norms in the enforcement of laws.

imposes an upper bound on firms' actions.[13] The payoff is represented by:

$$u_i(b_i, \theta_i) = -a(b_i - \theta_i)^2 - (1-a)(b_i - B_j)^2 - \gamma \sum_{i \in N} b_i - \mu I_{\{b_i > L\}} \phi \tag{2.1}$$

where the element of trust shared in society j is introduced by B_j as the expected action of other firms. I assume that higher trust leads to a lower expected polluting action of other firms. The parameter $a \in (0,1)$ is an (inverse) measure of social sensitivity that governs the relative importance of matching one's own type versus matching the expected average action of other firms as shown in the first two terms.[14] γ captures negative externalities from the total emissions in society. It justifies interpreting lower B_j as higher trust because given this society-wide externality, trust or perceived trustworthiness of other firms leads to the expectation that other firms will choose lower actions for the common good. The last term subtracts the fine ϕ imposed on noncompliant firms, those choosing $b_i > L$, conditional on there being a formal inspection by the authority with probability μ.

Given the set-up, there is a threshold type $\theta^* = f(B_j, L, \mu, \phi)$, beyond which all types violate the regulation and below which all types comply with the regulation.[15] It is then straightforward to show that fewer firms violate the regulation (i.e., θ^* increases) when trust is higher (B_j is lower), the regulation is less stringent (the upper bound L is higher), and formal enforcement rules are stricter (μ and ϕ higher).[16]

The two potential channels discussed so far share the prediction that higher levels of trust lead to more compliance, which I bring to the data in the following sections. It is challenging to distinguish these two potential channels empirically. Later I attempt to provide suggestive evidence for the presence of internalized corporate culture by looking at multinational firms' compliance behavior when they operate abroad.

2.4 Institutional background

In this section I provide a brief background on the European Union Emissions Trading Scheme (EU ETS) and its compliance cycle. Launched in 2005, the EU ETS is the world's largest carbon trading market operating in 31 countries (all 28 EU countries plus Iceland, Liechtenstein and Norway). It limits emissions from heavy energy-using installations (including power stations and industrial plants) and airlines operating between

[13] Firm i' type $\theta_i \in [0,1]$ is distributed according to a cumulative distribution function F. For simplicity, F is assumed to be strictly increasing and continuous on [0,1] with $F(0) = 0$ and $F(1) = 1$.

[14] Note that deviation in both directions is equally costly. For deviation from the prevailing action in the opposite direction (complying when others violate), Fehr and Gächter (2000a) provide experimental evidence that there is a strong aversion against being the "sucker" who cooperates when others do not.

[15] The existence of a threshold type follows from the monotonicity of the first order conditions. I provide a formal proof of this statement in Section B.3 in Appendix B.

[16] Similarly, I formally show $\frac{\partial \theta^*}{\partial B_j} < 0$ in Appendix B.

these countries covering around 45% of the EU's greenhouse gas emissions. Its geographic coverage, as large as all of Europe, offers a unique setting to investigate the extent to which compliance behavior with respect to the same regulation may differ across countries due to the differences in trust and civicness of the population.

The EU ETS is currently in its third phase that runs from 2013 to 2020, having gone through the first two phases. Phase 1 ran from 2005 to 2007 and was considered a pilot phase. The second phase ran from 2008 and 2012, the same period as the first commitment period under the Kyoto Protocol. In the first two phases, most allowances were allocated for free (i.e., grandfathered) to regulated installations based on historical emissions and the amount of allowances was decided via National Allocation Plans (NAPs) in each participating country. In phase 3, however, around 50% of total allowances are auctioned (with full auctioning for the power sector), with the share set to rise over the course of the trading period. Also, allocation is determined through common rules agreed at the EU level to improve transparency and harmonization of the permit allocation process across countries.

Integral to the scheme's successful implementation is the Monitoring, Reporting and Verification (MRV) system, known as the ETS compliance cycle. As a primary actor in all related procedures, operators of industrial installations and aircraft operators (henceforth called installations) are required to monitor and report their annual emissions to the Competent Authority (CA), one or more institutions within each country designated to ensure smooth running of the compliance cycle of the EU ETS.[17]

Specifically, installations report their emissions of the previous year verified by third-party accredited verifiers by 31 March of each year. Installations are then required to surrender a quantity of allowances equal to the volume of their verified greenhouse gas emissions of the previous year by 30 April of that year. An installation is considered out of compliance if the number of allowances surrendered by 30 April is lower than its verified emissions.[18] Noncompliant installations are subject to the EU level penalty for the amount of emissions for which the installation failed to surrender allowances (40 euro per tCO_2 in phase 1 and 100 euro per tCO_2 in phase 2 and 3) and the shortfall in compliance is then added to the compliance target of the following year (i.e. paying a fine does not exempt noncompliant installations from their obligations to surrender sufficient allowances).

I focus on noncompliance in the form of not surrendering enough permits, for which all regulated installations face the same penalty and which I observe in the data. However, there are other forms of noncompliance such as failing to report changes in the installa-

[17] 15 out of 31 participating countries have one centralised CA that deals with all aspects of the ETS including permit allocation and compliance, whereas the rest has multiple CAs.

[18] In addition to EU allowances (EUAs), firms can use international credits such as Certified Emission Reductions (CERs) and Emission Reduction Units (ERUs) from the Clean Development Mechanism (CDM) and Joint Implementation (JI) from phase 2 with qualitative and quantitative restrictions.

tion's capacity or monitoring plans. With regard to these, each national government is required to lay down penalties that are "effective, proportionate, and dissuasive" (Article 16(1) of the Directive). The presence of these country-specific enforcement rules for other forms of noncompliance may have impacts on overall compliance behavior. This feature introduces difficulties in identifying the role of trust in regulatory compliance across countries (i.e. it would be problematic if high-trust countries also have more stringent enforcement rules and more frequent inspections). In later sections, I propose identification strategies that overcome this obstacle.

2.5 Data description

2.5.1 Compliance in the EU ETS

Data on compliance in the EU ETS is provided by the European Union Transaction Log (EUTL), a system harmonized at the EU level that publishes information on compliance status, permit allocation, verified emissions, and surrendered allowances at the installation level. Existing papers that have studied compliance behavior of firms have focused on a single industry or several industries in a single country.[19] While providing valuable insights into various motivations behind compliance decisions, these studies are unable to shed light on the systematic differences in compliance behavior caused by cultural traits such as trust, which largely varies at the country level. I address this lacuna by taking advantage of this unique international dataset that contains installations operating in multiple industries and multiple countries.[20]

I use information on compliance status from 2005 to 2015 that includes all three phases so far. There are five possible compliance codes installations can be given: (1) A, when the number of allowances and permits surrendered by the deadline (30 April) is greater than or equal to verified emissions, (2) B, when the number of allowances and permits surrendered by the deadline is lower than verified emissions, (3) C, when verified emissions were not entered until the deadline, (4) D, when competent authority corrected verified emissions after the deadline and decided that the installation is not in compliance, and (5) E, when competent authority corrected verified emissions after the deadline and decided that the installation is in compliance. The distribution is reported in Table 2.2.

[19]For single industry studies, see, for example, Gray and Deily (1996) for the US steel industry, Shimshack and Ward (2005, 2008) for the US pulp industry. Multi-industry studies include Dasgupta et al. (2000) for Mexico, Decker and Pope (2005) and Evans (2016) for the US, Nyborg and Telle (2006) for Norway, and more recently Duflo et al. (2014) for India.

[20]I drop Cyprus, Iceland, Liechtenstein, Malta, and Luxembourg since there are too few installations (less then 50) operating in these countries, thus may not represent the culture of the environment in which they operate. Due to the small number of regulated installations, in some cases, technical aspects of monitoring, reporting and verification procedures were delayed (for instance, Malta), which could affect the compatibility of the data. I also drop Croatia that joined the ETS in 2013.

Based on this categorization, I construct a binary noncompliance variable that takes 1 if an installation is given either B or D and 0 if an installation is given either A or E. In my preferred specification, I treat compliance status of code C as missing in order to be conservative.[21] Alternative specifications such as considering A and B only or treating C differently yield similar results.

The cross-country compliance rates depicted in Figure 2.5 reveals startling variation across countries. It is noteworthy that the distribution (Figure B.3) is highly right-skewed with a majority of countries close to full compliance and several countries with very high noncompliance. Some countries such as Bulgaria, Italy, and Slovakia, have close to or over 10 percent noncompliant installation-year observations. However, the mean noncompliance rate is very low – 3.2 percent – and half the countries countries show less then 1 percent noncompliant observations during the sample period.

Figure 2.6 shows noncompliance rates by year. The occurrence of noncompliance was very high in 2005 (59% of all noncompliance occurring in the first year) and the rate was substantially lower in 2006 onwards. In case the cross-country pattern observed in 2005 is an outlier I exclude 2005 and calculate noncompliance rates across countries. A similar cross-country pattern continues to exist, albeit with lower magnitudes, as shown in Figure B.4 with Bulgaria, Italy and France appearing high in the ranking. Even without 2005, noncompliance tends to be less frequent in phase 2 and phase 3. One possible reason is that the EU level fine for the amount of emissions for which the installation failed to surrender allowances increased by 2.5 times starting from phase 2 (40 euro per tCO_2 in phase 1 to 100 euro per tCO_2 in phase 2 and 3).

[Figure 2.5, 2.6]

2.5.2 Measuring trust

As briefly explained in Section 2.2, the ESS measures generalized trust – the expectation that a random member of the society is trustworthy – by asking the classical question, "Generally speaking, would you say that most people can be trusted, or that you can't be too careful in dealing with people?".[22] Respondents' answers are given on a scale of 0 to

[21] Although failing to report verified emissions is strictly speaking noncompliance, two observations call for a more cautious approach. First, among observations with compliance status C, around 80 percent have incomplete information on permit allocation, either missing or zero even in the first two phases when most permits are given for free based on their historical emissions. Second, these installations tend to have missing verified emissions for multiple periods followed by missing compliance status in the following periods. Taken together, it is possible that these installations were no longer regulated (or active) and therefore did not have reporting obligations.

[22] The ESS also measures trust that respondents have in parliament, legal system, the police, politicians and political parties. These measures can also explain compliance patterns and are highly correlated with the measure of generalized trust (the smallest pairwise correlation coefficient being 0.84 between trust in parliament and generalized trust). However, they are likely to reflect the quality of the corresponding

10, where 0 implies "You can't be too careful" and 10 means "Most people can be trusted". The variable that I use in the econometric regression is the average of this answer within the country where the installation is located. For identification purposes, I later also explore the importance of trust prevalent in the location of the firm's headquarters (that owns the installation) when the firm's headquarters are located in a different country and therefore likely to be exposed to a different set of values and corporate culture.

This trust question appears in several other surveys including the World Value Survey (WVS) with the same wording and has been the most widely used tool to measure trust across countries in the literature.[23] A number of papers have confirmed that it is indeed correlated with trusting behavior. Fehr et al. (2003) show that survey questions of this type do capture trust by running a series of experiments, and Fehr (2009) further demonstrates that the survey measure of trust is strongly correlated with the behavioral measure of trust derived from trust games. On the contrary, Glaeser et al. (2000) provide experimental evidence that the survey question captures the trustworthiness of respondents rather than trust; but, this conflicting finding has been reconciled by Sapienza et al. (2013) who show that subjects in a homogeneous sample (such as Harvard undergraduates as in Glaeser et al. (2000)) tend to extrapolate the trustworthiness of others based on their own trustworthiness. However, in a large anonymous sample (such as random individuals in Germany as in Fehr et al. (2003)) in which respondents are not extrapolating expected trustworthiness of others based own their own trustworthiness, the survey question does seem to capture trust. Thus, I believe the trust measure from the ESS is appropriate for the purpose of my analysis that investigates the role of trust in compliance decisions by firms.

[Figure 2.7]

Figure 2.7 plots the average level of trust by country. Two points are noteworthy. First, as shown in previous studies, there exists substantial variation in trust across countries. The average level of trust ranges from a minimum of 3.8 observed in Portugal to a maximum of 6.9 in Denmark. Second, it is readily observable that there are differences across regions of Europe; for instance, Nordic countries (Denmark, Norway, Finland, and Sweden) display highest levels of trust in the sample. On the other hand, Mediterranean countries such as Greece, Italy, and Portugal appear to have lower levels of trust. Continental European countries tend to be in the middle of the trust ranking.[24]

institutions, whose effect on compliance I try to remove in order to focus on the effect of trust as culture. Thus I believe it is appropriate to focus on this measure of generalized trust in my analysis.

[23] Another popular approach is to measure trust in a trust game in experiments. See Johnson and Mislin (2011) for a meta-analysis of an extensive number of trust games in the literature. However, a clear limitation of this approach to measure trust is that it is difficult to derive a measure that is compatible across countries. There are multi-country experiments (e.g. Akai and Netzer (2012)), but still the sample tends to be not large enough to allow a rigorous cross-country econometric analysis.

[24] It is beyond the scope of this paper to explain the sources of variation in trust across countries.

2.5.3 Firm-level controls

Data on firm characteristics comes from Bureau Van Dijk's Orbis Database. The account holders' information in the EU ETS (i.e., regulated installations) was matched to the corporations in the Orbis Database in Calel and Dechezleprêtre (2016). Only less than 3 percent of installations are left unmatched. I obtain key financial variables that may affect compliance decisions (i.e., firms may be too financially constrained to buy enough permits) including the number of employees, operating revenue and total assets for the sample period as well as firms' ownership structure in 2015 and the number of installations run by each firm. These controls will also account for firm-level heterogeneity more generally. Table B.1 in Appendix B reports the descriptive statistics of these variables for firms in each country.

2.6 Trust and compliance

The discussions in the conceptual framework in Section 2.3 predict that greater trust leads to higher compliance, or fewer firms violating the regulation. In this section, I subject this prediction to rigorous econometric investigation.

2.6.1 Using inherited trust as instruments

The negative correlation between trust and noncompliance documented in Section 2.2 is consistent with the theoretical prediction. However, it is possible that trust picks up the effect of country-specific regulatory environment or institutional capacity that might be correlated with trust, given the documented influence of trust in shaping institutions and regulations (Algan and Cahuc, 2009; Aghion et al., 2010, 2011). Relatedly, Cohen (1998) and Brehm and Hamilton (1996) have argued that the presence and characteristics of other environmental regulations may affect compliance behavior of firms through higher degrees of familiarity and knowledge with compliance procedures. I included a measure that controls for rule of law and the perceived quality of regulation in Section 2.2.2, but it may not be perfect.

It is also plausible that the correlation could also be explained by some unobservable factors that affect regulatory compliance of firms and the level of trust within the country simultaneously.[25] For instance, Carattini and Jo (2017) document that high-trust

There is a related literature devoted to this question. For historical determinants of differences in cultural norms of behavior, see Tabellini (2008a); Durante (2010); Nunn and Wantchekon (2011). Guiso et al. (2009) explore several long-term determinants of *bilateral* trust between two countries. For studies that emphasize short-run determinants of trust, see Glaeser et al. (2000), and Alesina and La Ferrara (2002), and Jo (2017).

[25] I believe the threat of reverse causality is minimal given the extensive evidence on the importance of

countries have reduced their per capita CO_2 emissions more substantially than low-trust countries between 1950 and 2010. Then, one might argue that it might be easier for installations in high-trust countries to comply with the EU ETS since they already operate in an environment more conducive to reducing emissions. Thus, what I need is a measure that can predict the average level of trust in a country, but uncorrelated with country-specific formal institutions and other unobservable features that may affect compliance behavior of firms.

One such measure is the *inherited* component of trust observed in second-generation immigrants. This epidemiological approach has gained recognition in the literature (Fernandez, 2007) and been adopted by several papers that attempt to isolate the causal effects of trust on economic outcomes (Algan and Cahuc, 2010; Butler et al., 2016; Carattini and Jo, 2017). The insight is based on the evidence that trust is highly persistent across generations through the transmission of values within families (Rice and Feldman, 1997; Putnam, 2000; Guiso et al., 2009). Then, inherited trust observed in second-generation immigrants is expected to be correlated with the level of trust in their countries of origin where their parents came from, and yet unlikely to directly affect compliance behavior of firms operating in their source country since they are born and reside in their adopted countries.

[Figure 2.8]

I apply this idea to my analysis by using, for example, the average level of trust among second-generation British immigrants born and raised in any of the other ESS countries to predict the level of trust in Britain. The exclusion restriction is then trust of second-generation British immigrants born and living in Spain, for instance, should not directly affect compliance decisions of regulated firms operating in Britain between 2005 and 2015. The number of second-generation immigrants from each country from which I estimate this measure of inherited trust is reported in Table B.2 in Appendix B. Figure 2.8 clearly depicts a strong positive correlation between the inherited trust of immigrants and the level of trust observed in their source county, which ensures a strong first stage.

I estimate regression equations of the following form:

$$Noncompliance_{ijct} = \alpha + \beta Trust_c + \phi C_{ct} + \rho F_{ijct} + \delta Year_t + \xi Industry_j + \epsilon_{ijct} \quad (2.2)$$

where $Noncompliance_{ijct}$ is a binary variable that takes 1 if firm i in industry j in country c is out of compliance in year t. $Trust_c$ is the average trust of country c where installations are located. It is reasonable to suppose that the variable does not vary over time during the 11-year period I study, given the persistent nature of trust across generations.[26] Most

historical determinants of trust (Guiso et al., 2009; Durante, 2010; Tabellini, 2010; Nunn and Wantchekon, 2011).

[26]To formally test if there is time variation over the study period I check whether there is overlap in

empirical analyses in the trust literature follow this approach by taking the average of trust in surveys conducted since the 80s (e.g. Tabellini, 2010; Bloom et al., 2012b).[27] Therefore, I run a pooled regression despite the panel nature of the dependent variable. To avoid understating the standard errors due to repeated observations, the errors are clustered at the country level over all years. C_{ct} and F_{ijct} represent country-level controls and firm-level controls. I further include year dummies and industry dummies.

[Table 2.3]

Table 2.3 reports IV probit estimates. Column (1) first shows the IV estimates from the regression that does not include any controls to begin with. The coefficient on trust is negative and statistically significant (with P-value 0.018). The instrument is strong with F-statistics over 40. Column (2) includes year dummies and industry dummies, which will capture industry-specific characteristics that may affect compliance such as available abatement technology or market situations. In column (3), I include country-level controls such as log GDP per capita, log population, educational attainment and two governance indicators that measure country-wide rule of law and perceived regulatory quality (summary statistics of these variables are reported in Appendix B). In column (4), I further include firm-level variables such as the number of installations each firm owns (to control for economies of scale in compliance) and operating revenue, total assets and number of employees to control for the possibility that firms were too financially constrained to buy permits. Due to the large number of missing values in these firm-level financial variables, the sample size falls substantially, and yet the negative relationship between trust and noncompliance remains robust.[28] Column (5) shows the reduced form relationship between inherited trust and noncompliance. The 2SLS estimate from a linear probability model is qualitatively similar with a coefficient (standard error) of -0.049 (0.028).

The magnitude of the association between trust and compliance is substantial. The estimate from column (4) that includes the full set of controls implies a 1 standard deviation increase in trust (roughly from trust in Italy to trust in Netherlands) is associated

the 90% confidence intervals of the trust variable for the start and end year using 2000 and 2014 wave, respectively. Only two out of 25 countries in my sample have non-overlapping confidence intervals over this period.

[27] Few studies exploit time variation in trust with a notable exception being Algan and Cahuc (2010). They suggest a methodology to recover long intertemporal variation in trust by comparing immigrants who moved to America from different countries at different points in time and generate a trust measure for 25 countries with time variation over 60 years, which arguably covers multiple generations. Their trust variable measures trust in two points far apart in time, 1935 and 2000, to allow sufficient time for the evolution of trust. Algan and Cahuc (2009) also exploit time variation in trust over 20 years in one of the specifications, using only the end points of their data (1980 and 2000) to get enough variation.

[28] To make sure the presence of missing values does not alter the distribution of compliance, I check if the compliance rate differs with and without observations with missing firm-level controls and find that the distribution of the dependent variable (noncompliance) is not statistically different across the two groups (with P-value of the test statistics 0.64).

with a 2.4 percentage point decrease in the probability of noncompliance.

Some papers have exploited within-country regional variation in trust for identification purposes (Guiso et al., 2004; Tabellini, 2010; Bloom et al., 2012b). I also try a trust measure at the region level in column (6) and find consistent results. The most prominent benefit of exploiting regional variation in trust is that it allows including country fixed effects and the studies mentioned above successfully combine country fixed effects with region-level instruments to estimate the causal effects of trust. However, the difficulty of adopting this approach in my context is that country fixed effects will make it impossible to use my instrument, which is at the country level (the *region* of origin of immigrants is not asked in the ESS).[29] In the next section, I suggest an alternative design that allows both using the instrument and country fixed effects.

2.6.2 Exploiting differences in the location of headquarters

About 80 percent of installations (10,692 in total) for which I have ownership data are owned by multinational firms (MNEs) and 4,310 of them are owned by foreign MNEs whose central headquarters are located in a different country from the country where the installations operate. This subsample offers a chance to further probe the causality of the relationship that I attempted to estimate so far by allowing country of operation fixed effects. Country fixed effects remove any bias associated with unobservable national characteristics that may be spuriously correlated with trust and compliance. I then compare compliance behavior of installations that are exposed to the exact same external environment (e.g. legal enforcement, stringency of other related regulations, etc.) but have different levels of trust coming from the country of origin.

The importance of country of origin characteristics in MNEs' management and organizational structure has long been recognized in the relevant literature. A study most relevant to my analysis is Bloom et al. (2012b) where they provide evidence that the level of trust prevalent in the country where the multinational is headquartered has a strong positive effect on the degree of decentralization in the affiliate's foreign location (for instance, a Swedish affiliate operating in the US is typically more decentralized than a French affiliate in the US). Furthermore, Bloom et al. (2012a) show that US multinationals operating in Europe displayed higher productivity in the use of information technologies (IT) than non-US multinationals in Europe during the period when the US experienced a rapid productivity growth in sectors that intensively use IT. Burstein et al. (2009) and Bloom and Van Reenen (2007) also document the transmission of knowledge

[29] Another concern is that there might not be enough regional variation in trust once country dummies are included, given that my sample includes 25 European countries, many of which are culturally homogeneous. Previous studies that exploited regional variation in trust focused on large countries known for substantial within-country variation in trust including Italy (Guiso et al., 2004; Tabellini, 2010) or on the entire world Bloom et al. (2012b).

and management practices across countries in MNEs. Given this ample evidence on the influence of source-country characteristics over MNEs' operation abroad, it seems legitimate to investigate whether there might be different patterns in compliance behavior across multinationals based in different countries.

It is possible, however, that some firms might have experienced changes in ownership through mergers and acquisitions (M&As) just before or while being subject to the EU ETS. In particular, if firms are recently bought out by foreign enterprises that may have substantially different source-country characteristics, the level of trust prevalent in the country where the new headquarters are located might not precisely predict the compliance behavior of their installations.[30] To reduce the potential measurement error arising from this scenario, I identify firms that were bought out by foreign companies (i.e., target firms in foreign M&A deals) since 2000, five years prior to the start of the ETS, using rich M&A data from Bureau Van Dijk's Zephyr Database. There are only a small number of such firms in my sample (264 out of 8,156 firms). I drop 573 installations owned by these firms from the regression.

The results of this analysis are reported in Table 2.4. For this exercise, I construct another trust measure from the World Value Survey (WVS) since there are a number of non-European countries in which MNEs in my sample are headquartered and thus not included in the ESS.[31] As before, I pool together individual responses from all six waves conducted so far (1984, 1993, 1999, 2004, 2009, and 2014), and compute the average level of trust in the country where the global headquarters of the installation is located.[32] I later also check for the independent role of trust in the installation's location.

[Table 2.4]

Column (1) shows the relationship between compliance and the level of trust in the country where the central headquarters are located without any controls. Standard errors are clustered at the country level. The coefficient is negative and significant at 1 percent level, which suggests that trust prevalent in source countries is positively correlated with the affiliates' compliance decisions. The influence of trust in the country of headquarters remains strong even when I control for individual firm-level characteristics in column (2). Next, I include country of operation fixed effects as well as year and industry fixed effects. The magnitude of the coefficient falls sharply with an extensive set of fixed effects, but the coefficient in column (3) is still negative and significant. This implies that installations

[30]The case of firms in my sample buying other firms, as opposed to being bought out, is not likely to introduce measurement error in the trust variable because it does not bring about changes in the relationship between pre-existing subsidiaries and their global owners that I exploit here.

[31]There are 44 source countries in my sample and the median (mean) number of firms headquartered in each source country is 28 (103).

[32]The only difference in the trust question in these two surveys is the scale used for the answer. While the ESS uses the scale of 10, the WVS provides a binary choice between 0 and 1 where 0 implies "You can't be too careful" and 10 means "Most people can be trusted".

owned by firms based in high-trust countries are less likely to violate the regulation than those owned by firms in low-trust countries, even when they operate in the same country. In column (4), I add the level of trust in the location where the installation operates (at the region level, since the country-level measure will be omitted due to country fixed effects). The coefficient on trust in the region of installation is insignificant, while the role of trust in the country of headquarters remains negative and statistically significant with a similar magnitude as in column (3).

It is still possible that an endogeneity bias is affecting the coefficient of trust even with country fixed effects. For instance, Bloom et al. (2012b) show that MNEs with headquarters in high-trust countries are larger in firm size and more productive than those with headquarters in low-trust countries. If compliance behavior is correlated with these firm characteristics related to trust that I cannot directly control for (although I control for the number of employees), the estimate might be biased. Thus I apply the same instrument developed in the section above to further probe the role of trust in compliance behavior. The measure of inherited trust observed in second-generation immigrants is still valid in this context, since it predicts the level of trust in their source countries but unlikely to be correlated with the organization and performance (such as size and productivity) of MNEs headquartered in those countries. Column (5) reports the IV estimates. The coefficient is more negative when instrumented and still statistically significant. Column (6) shows the presence of a negative and significant relationship between noncompliance and the measure of inherited trust in the reduced form. In column (7), I further include time-varying country-level controls in addition to the country of operation fixed effects. The negative relationship between trust and noncompliance remains robust. Column (8) includes *region* fixed effects, comparing compliance decisions of MNE's based in different countries operating within the same region. Even in this demanding specification, the influence of trust in the MNE's source country continues to exist. Repeating this specification in a linear probability model yields similar results (unreported).[33]

Not only is the estimated effect of trust on compliance statistically significant, it is also economically meaningful. The estimate in column (5) implies that a change in ownership from a multinational firm based in Philippines (the lowest-trust country in my sample) to another MNE headquartered in Norway (the highest-trust country) would be associated with a 1.5 percentage point decrease in the probability of noncompliance. How large is this effect relative to that of formal enforcement on compliance? To provide a sense of magnitude, I compare this effect with other existing estimates for the effectiveness of formal enforcement actions reported in previous papers. Estimates for the effect of traditional regulatory measures (e.g. inspections and fines) range between 42 and 52 percent treatment effects (Gray and Shimshack, 2011).[34] Also, Evans (2016) documents

[33]It yields a coefficient (standard error) on the trust measure of -0.023 (0.010).

[34]Deily and Gray (2007) studied the deterrent effects of regulatory measures on compliance in the

that an information-based enforcement tool such as the "watch list" in the Clean Air Act is associated with a 21 percentage point decrease in the probability of noncompliance, indicating a 29 percent treatment effect given the average noncompliance rate 72 percent. Compared with these previous estimates, the effect of trust still seems large: given the average compliance rate of 3.2 percent in my sample, the predicted fall in the probability of noncompliance by 1.5 percentage point caused by the change in ownership from a Filipino firm to a Norwegian firm implies a 47 percent treatment effect.

2.6.3 Robustness checks

In this section I report the results from a number of robustness checks. Table B.3 reports robustness checks for the cross-country analysis using all firms (as in Section 2.6.1) where I try to (1) drop late joiners in the EU ETS, (2) use alternative specifications for noncompliance, (3) use alternative measures of trust, (4) use an alternative specification for the measure of inherited trust, and (5) check if installations' compliance behavior is different also at the intensive margin, i.e., if the amount by which installations are noncompliant can also be explained by the level of trust. Here I focus on the main results from the specification using MNEs that includes country of operation fixed effects. First, I add region-level economic controls (log GDP per capita, log population and the percentage of population with tertiary education) in addition to country of operation fixed effects (column (1) in Table 2.5). Also, I exclude Bulgaria and Romania that joined the EU ETS later, in case there might have been technical difficulties arising from immature infrastructure. Bulgaria and Romania started to participate in the ETS in 2007 when they joined the European Union in the same year.[35] Excluding these late joiners does not affect the relationship between trust and compliance (column (2)).

[Table 2.5]

Next, I try alternative specifications for the binary noncompliance variable. In my preferred specification, I dropped installations with compliance status C that did not report their verified emissions (the step before they surrender corresponding amount of permits) in order to be conservative because there is suggestive evidence that these installations are no longer regulated or active (see footnote 21). Alternatively, I treat these installations as noncompliant when they can be reasonably presumed to be active

Clean Air Act using compliance data on large steel mills in the Unites States. They found that being subject to an enforcement activity in the prior two years decreased the probability of noncompliance by 32 percentage point. Given the overall noncompliance rate 62 percent, the estimate suggets a 52 percent treatment effect. In a similar context, using compliance data on pulp and paper mills Gray and Shadbegian (2005) found that a typical regulatory action decreased the probability of violation by 10 percentage point, implying a 42 percent treatment effect (with the average violation rate 24 percent in the sample).

[35] Croatia also joined the ETS in 2013 and is already dropped from my sample along with five small countries with less then 50 installations.

by two standards: first, when they have non-missing information on permit allocation in the current period and second, when they have non-missing compliance status other than C in the following period. The regression in column (3) uses this alternative measure of noncompliance. The magnitude of the coefficient on the trust measure falls but it remains significant at 10 percent level. I also try to drop installations whose verified emissions were corrected later by the competent authority (i.e. those with code D and E) and find similar results (column (4)).

In column (5) and (6) I try alternative measures of trust to get a sense of potential measurement error in the trust variable. First, I construct a measure that takes into account year-specific shocks since I pool multiple waves conducted in different years to calculate the average level of trust in each country. Following Bertrand et al. (2004) and Guiso et al. (2009), I regress trust on year dummies, form residuals, and then compute the means of these residuals by country. Column (5) shows that the coefficient on this alternative measure of trust is still negative and significant at 1 percent level. Next, I try a potentially more demanding approach that further takes into account individual respondents' characteristics such as gender, age, education and income as well as year dummies. To proceed, I follow Algan and Cahuc (2010) by regressing trust on a set of individual characteristics, year fixed effects and country fixed effects. The coefficients on the country fixed effects then measure the average level of trust relative to the omitted reference country (Germany, in this case). The results from the individual-level regression are reported in Table B.5 in Appendix B. The fact that coefficients on the country dummies are significant (with standard errors clustered at the country level) even after controlling for a set of individual characteristics and year dummies confirm the substantial cross-country variation in trust documented in the literature. Column (6) reports the IV probit estimate from the specification using this alternative trust measure and shows the results consistent with previous findings. The effect of trust on compliance remains robust across different measures of trust.

Finally, I try an alternative specification of the instrument that imposes a minimum of 25-year lag between the launch of the EU ETS and the year of immigration of the second-generation immigrants' parents as in Algan and Cahuc (2010) . This is to further ensure that the exogeneity assumption is satisfied, since I only use second-generation immigrants born before 1980 and therefore whose parents must have left their source countries before 1980, at least 25 years (one generation) prior to the start of the ETS in 2005. Then it is even less likely that the level of trust transmitted by those who left the country at least 25 years ago still affects compliance behavior of firms in that country. Column (7) shows that the result with this instrument is very similar and the modified instrument still has a strong predictive power (F-stat is 18.6 and Figure B.5 graphically shows the positive correlation). Column (8) shows the presence of a negative and significant relationship between noncompliance and the alternative instrument in the reduced-form regression.

2.6.4 Extension: bilateral trust

Several papers have looked at the influence of *bilateral* trust between two countries in economic activities (Guiso et al., 2009; Bloom et al., 2012b). The measure of bilateral trust used in the literature comes from the following question in a series of surveys conducted for the European Commission: "I would like to ask you a question about how much trust you have in people from various countries. For each, please tell me whether you have a lot of trust, some trust, not very much trust, or no trust at all." This question allows me to explore the role of trust between the host and the source country in MNEs' compliance decisions controlling for country of operation and country of origin fixed effects at the same time and thus solely exploit the pairwise variation in trust. In other words, it will reveal, for instance, if a French affiliate is more likely to comply with the regulation in Belgium (that the French tend to trust) than in the United Kingdom (that the French tend to distrust).

[Table 2.6]

Column (1) in Table 2.6 shows that bilateral trust does not play a significant role in multinationals' compliance behavior when I include a full set of country of location and origin dummies (therefore this specification only includes foreign MNEs). The result is similar when I add firm-level controls in column (2). In case the bilateral trust variable is affected by endogeneity (for instance, better compliance behavior in the country of operation might engender trust towards the source country or there might be omitted bilateral factors affecting trust and compliance behavior at the same time), I use a measure of religious similarity between two countries developed in Guiso et al. (2009) to instrument for bilateral trust.[36] This measure is positively correlated with bilateral trust due to long-standing cultural affinities, but unlikely to affect regulatory compliance exhibited by firms. It yields a strong first stage (with F statistics of 22) as in previous studies, but the bilateral trust variable is still insignificant as shown in column (3). I add an additional instrument in column (4) that measures somatic distances, based on the average frequency of specific traits (hair color, height, etc.) present in two populations developed in Guiso et al. (2009) since people tend to trust other people who look like them more. The first stage F statistics continues to be strong (around 15). However, the coefficient on bilateral trust remains qualitatively similar with no meaningful impact.[37]

The result seems to suggest that firms do not comply selectively depending on the location of their operation: French subsidiaries are no more likely to be in compliance with

[36]This variable measures the probability that two randomely chosen individuals in two countries will share the same religion and is calculated by taking the product of the share of people in country i and in country j who have religion k and then sum across all religions k (where k includes Catholic, Protestant, Jewish, Muslim, Hindu, Orthodox, other affiliation, and no religion) based on the World Value Survey.

[37]When I only include the measure of somatic distances as an instrument (the first stage F-statistics is 9.7), the result is qualitatively similar (unreported).

the regulation in Belgium than in the United Kingdom. The finding is perhaps intuitive when we consider that the outcomes which bilateral trust has been shown to affect – for instance, trade flows between two countries in Guiso et al. (2009) and delegation of decision-making power from the CEO to the plant manager in Bloom et al. (2012b) – are indeed bilateral or relational. On the other hand, the nature of compliance decision resonates more closely with the concept of *generalized* trust that I focused on in this paper in a similar spirit that the use of checks rather than cash in Guiso et al. (2004) and more demand for business regulation against corrupt businessmen in Aghion et al. (2010) are related to generalized trust. Further, the finding here is consistent with Fisman and Miguel (2007) that provide evidence on the strong effect of source-country culture, rather than culture in the country of residence, on law-breaking behavior at the individual level.

2.7 Conclusion

In this article I have provided evidence on the positive role of trust in compliance as a potential factor that can explain the heterogeneity in the stringency of climate change regulations across countries. Trust or trustworthiness may positively affect compliance decisions through strong internalized norms or strong social punishment for non-cooperative behavior in high-trust societies.

The EU ETS and the data on compliance under this international regulation has provided a unique opportunity to investigate if countries differ in their compliance patterns with respect to the same international regulation due to the differences in trust and civicness. Using this data, I find strong empirical evidence that trust in the country where the installation is located has a positive influence on its compliance decision. Interestingly, the pattern continues to exist when I look within countries and compare compliance behavior of multinational subsidiaries whose central headquarters are located in different countries: installations owned by firms based in high-trust countries were more likely to be in compliance than those owned by firms located in low-trust countries, even when they operate in the same country thus exposed to the same formal enforcement environment. These results underpin the findings from the existing literature that emphasizes the influence of source country characteristics in MNEs' operation abroad.

One notable implication of my findings is that local norms, such as trust, could play a significant role in global cooperation problems such as climate change. In this article, I have shown that trust could affect the design of climate change legislation through its positive influence on compliance: higher compliance in high-trust countries may induce their governments to implement more stringent regulations that address global externalities than some of their neighbors, particularly when there is a binding international goal to be reached as in the case of the European Union. The argument is consistent with

the previous studies that suggest trust can affect institutional outcomes through how law-abiding people are.

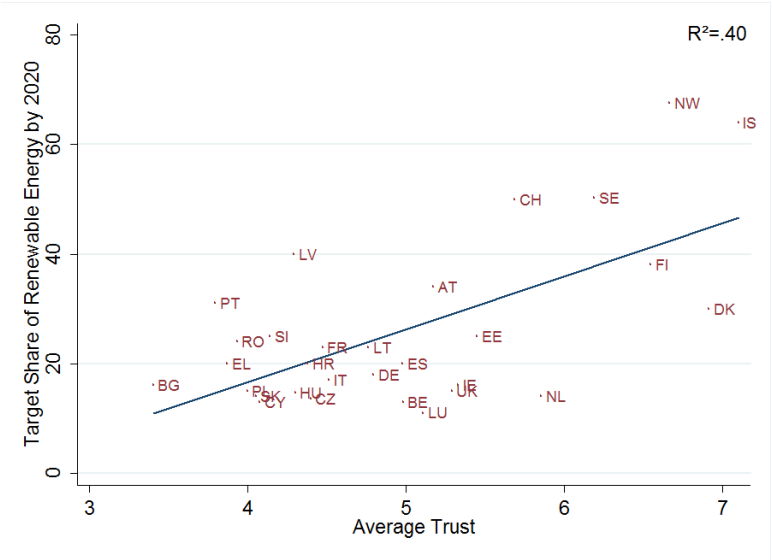
Another interesting implication is related to the idea of using corporations as a lab in which to study the role of culture. Although the role of culture in economic activities has long been recognized, economists' attempts to develop a deeper insight into specific workings of culture have not been straightforward because (1) it is difficult to know where culture comes from, (2) it is sticky with rare drastic changes, and (3) even when these cultural changes occur they take place over a long period with many other things happening at the same time. Guiso et al. (2015a) note this problem and suggest corporations as an alternative environment to study the role of culture. This is indeed promising since with corporate culture, we know (1) when, how, and based on what values corporations are founded, (2) corporate culture is subject to more frequent changes (e.g., through hiring, firing and M&As), and (3) performance is more easily measured (Guiso et al., 2015a). There is an increasing interest in this line of reasoning that sheds light on specific mechanisms behind the documented effect of culture at the macro-level. For instance, Bloom et al. (2012b) provides evidence on the influence of trust in firms' decision to decentralize, which allows more efficient resource allocation within and across firms that leads to higher firm productivity and economic growth. This serves as microevidence for the long-held belief that trust facilitates economic growth through lower transactions costs (Arrow, 1972). Similarly, this current article provides a plausible mechanism for the relationship between trust and climate change regulation by providing microevidence on the role of trust in compliance at the firm level. I concur with Guiso et al. (2015a) that these approaches substantially enhance our understanding of how cultural norms affect economic behavior and relate to formal institutions.

Figures and Tables

Figure 2.1: Correlation between Trust and Employment Protection Regulation

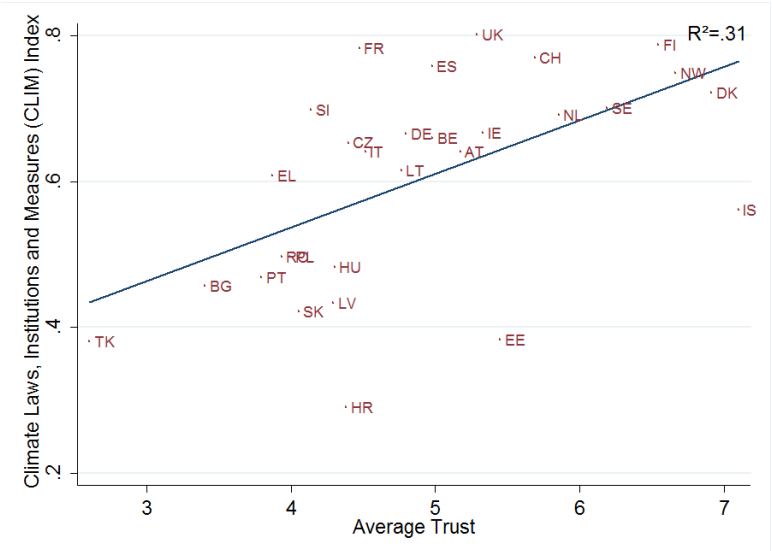
Note: the graph plots the relationship between trust and the stringency of labor market regulation. Data on the stringency of employment regulation comes from the OECD. The trust measure is constructed based on the European Social Survey (2000-2014).

Figure 2.2: Correlation between Trust and Renewable Energy Regulation



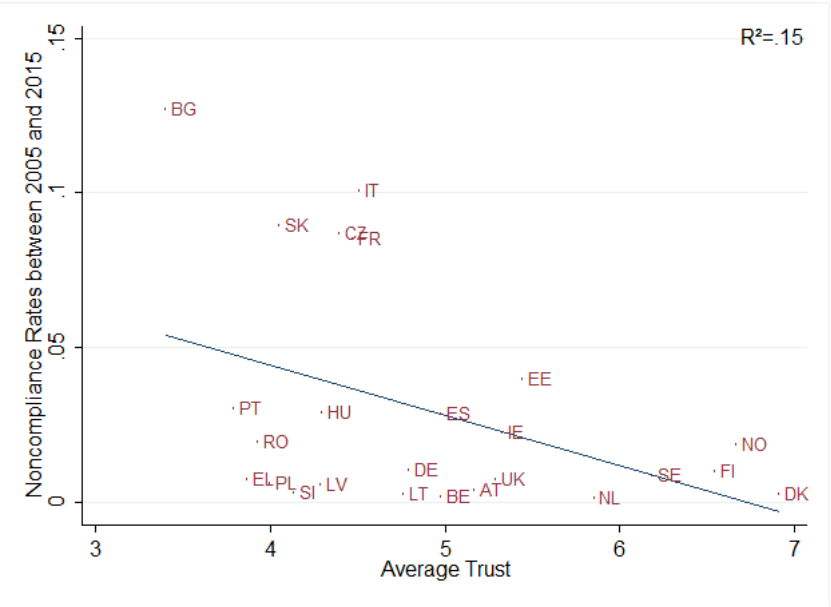
Note: the graph plots the positive correlation between trust and the stringency of climate change regulations across countries measured by the target share of renewable energy in total energy consumption by 2020. The trust measure is constructed based on the European Social Survey (2000-2014).

Figure 2.3: 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 the European Social Survey (2000-2014).

Figure 2.4: Correlation between Trust and Noncompliance Rate in the EU ETS



Note: the plot shows a correlation between the level of average trust and compliance rates in the ETS across countries. The level of average trust measure is constructed based on the European Social Survey (2002-2014).

Table 2.1: Probit Estimation: Trust and Noncompliance in the EU ETS between 2005 and 2015

	Dependent variable: Indicator for noncompliance					
	(1)	(2)	(3)	(4)	(5)	(6)
Trust measured in country of operation	-0.358***	-0.444***	-0.482**	-0.372*	-0.490*	-1.381**
	(0.111)	(0.150)	(0.217)	(0.222)	(0.270)	(0.680)
Observations	119,701	119,163	119,163	119,163	73,498	73,498
Firm-level controls (4)	No	No	No	No	Yes	Yes
Country-level controls (5)	No	No	Yes	Yes	Yes	Yes
Year dummies (10)	No	Yes	Yes	Yes	Yes	Yes
Industry dummies (35)	No	Yes	Yes	Yes	Yes	Yes
Clustering	Country	Country	Country	Country	Country	Country
Number of clusters	25	25	25	25	25	25

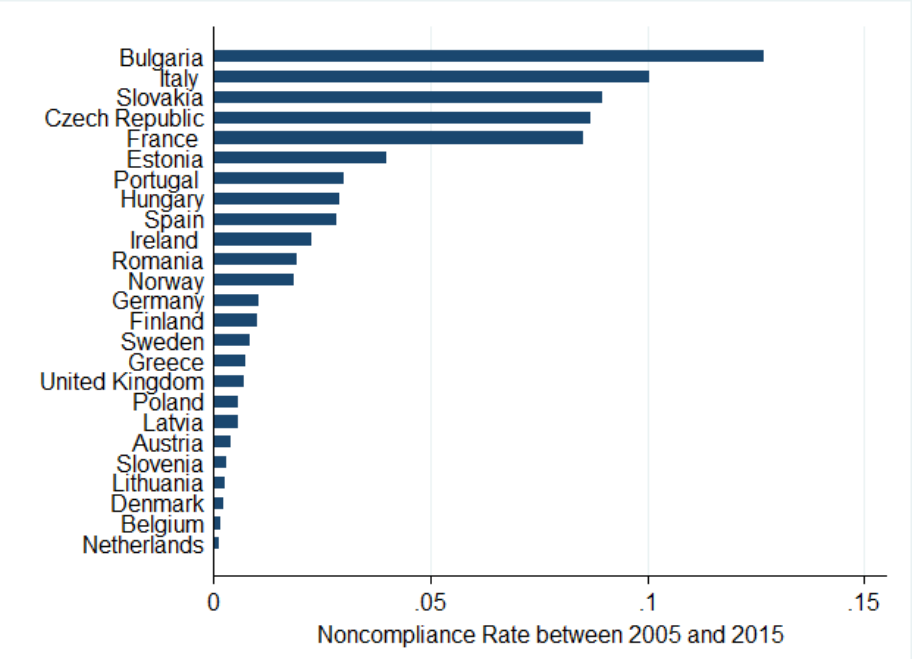
Notes: The dependent variable in all columns is the binary noncompliance measure that takes 1 if the installation is out of compliance and 0 otherwise. All estimation is by Probit except for column (6) where I try a logit model. Standard errors are clustered at the country of installations' location. "Industry dummies" are based on the main activity type information provided in the European Transaction Log. * significant at 10%, ** significant at 5%, *** significant at 1%.

Table 2.2: Distribution of Compliance Code, installation by year observations

Code	Frequency	Percent
A	122,647	93.93
B	4,010	3.07
C	3,273	2.51
D	86	0.07
E	563	0.43
Total	130,579	100.0

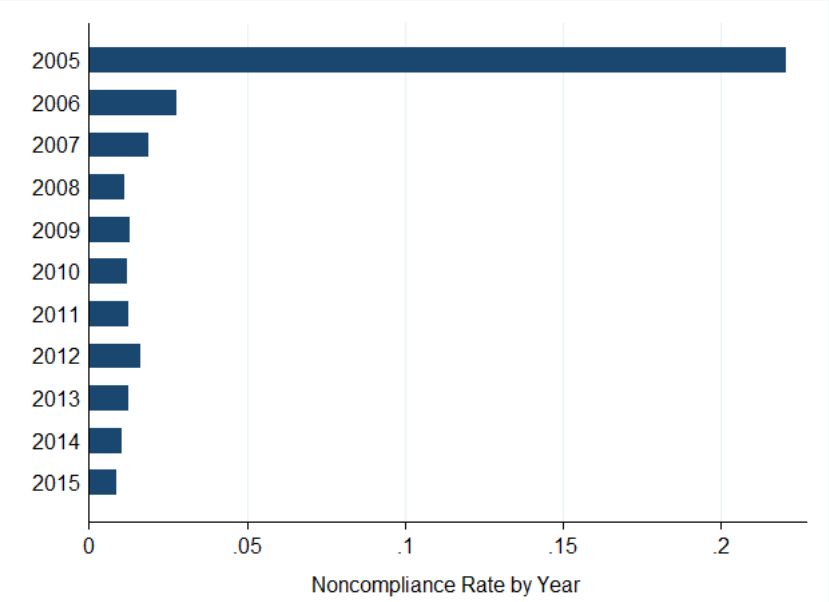
Source: European Union Transaction Log (EUTL).

Figure 2.5: Average Noncompliance Rate between 2005 and 2015



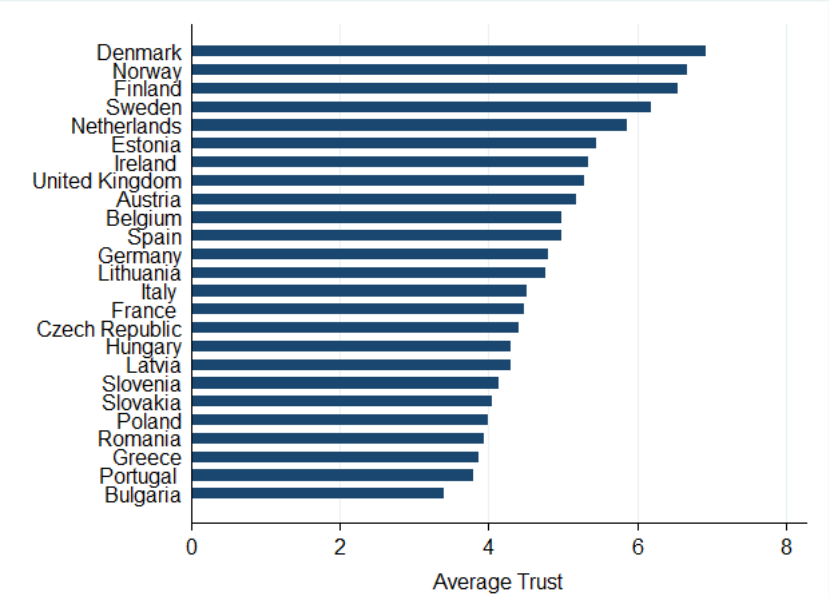
Note: the plot shows variation in noncompliance rates across countries. The data on compliance in the ETS is provided by the European Union Transaction Log (EUTL) at the installations level and I collapse the data over time across countries to calculate average compliance rates.

Figure 2.6: Noncompliance Rate by Year



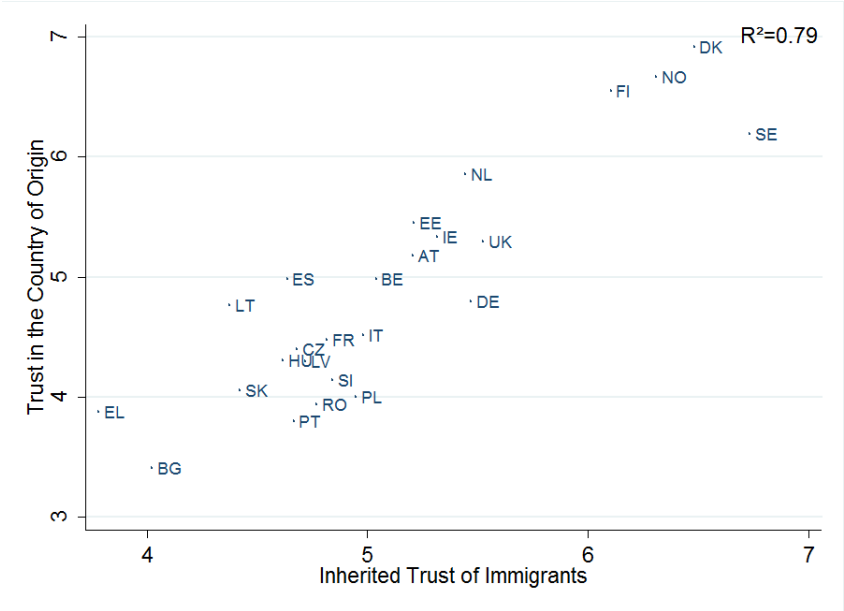
Note: the plot shows variation in noncompliance rates across years. The data on compliance in the ETS is provided by the European Union Transaction Log (EUTL) at the installations level and I collapse the data over countries to calculate average yearly compliance rates.

Figure 2.7: Average Trust



Note: the plot shows variation the level of average trust across countries. The level of average trust measure is constructed based on the following survey question "Generally speaking, would you say that most people can be trusted, or that you can't be too careful in dealing with people?" in the European Social Survey (2002-2014).

Figure 2.8: Correlation between Trust in Source Country and Inherited Trust



Note: the plot shows a correlation between inhered trust of second-generation immigrants and the level of trust in their countries of origin. These measures are constructed based on the following survey question "Generally speaking, would you say that most people can be trusted, or that you can't be too careful in dealing with people?" in the European Social Survey (2002-2014).

Table 2.3: IV Probit Estimation: Trust and Noncompliance in the EU ETS between 2005 and 2015

	Dependent variable: Indicator for noncompliance					
	(1)	(2)	(3)	(4)	(5)	(6)
Estimation method	IV Probit	IV Probit	IV Probit	IV Probit	Probit	IV Probit
Trust measured in country of operation	-0.459***	-0.575***	-0.750*	-0.865*		-0.892***
	(0.118)	(0.153)	(0.427)	(0.461)		(0.258)
Inherited Trust					-0.494*	
					(0.292)	
Observations	119,701	119,163	119,163	73,498	73,498	71,356
Firm-level controls (4)	No	No	No	Yes	Yes	Yes
Country-level controls (5)	No	No	Yes	Yes	Yes	Yes
Year dummies (10)	No	Yes	Yes	Yes	Yes	Yes
Industry dummies (35)	No	Yes	Yes	Yes	Yes	Yes
Clustering	Country	Country	Country	Country	Country	Region
Number of clusters	25	25	25	25	25	165
First stage F stat	40.4	45.0	32.1	60.2		57.7

Notes: The dependent variable in all columns is the binary noncompliance measure that takes 1 if the installation is out of compliance and 0 otherwise. Standard errors are clustered at the level shown in each column. "Industry dummies" are based on the main activity type information provided in the European Transaction Log. Column (1) shows an IV probit estimate without any controls. Column (2) includes year and industry dummies. Column (3) includes a set of country level controls (GDP per capita, education, population and two governance indicators). Column (4) further includes several firm-level controls (number of installations each firm owns, total assets, operating revenue, and number of employees). Column (5) shows the reduced form relationship between noncompliance and the instrument. Column (6) uses a measure of trust that varies at the region level. * significant at 10%, ** significant at 5%, *** significant at 1%.

Table 2.4: Trust and Noncompliance in the EU ETS between 2005 and 2015:
Exploiting the Differences in the Location of Headquarters

	Dependent variable: Indicator for noncompliance							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Estimation method	Probit	Probit	Probit	Probit	IV Probit	Probit	IV Probit	Probit
Trust measured	-1.596***	-1.616***	-0.390*	-0.417**	-0.591***		-0.559**	-0.425*
in country of central headquarter	(0.380)	(0.343)	(0.204)	(0.207)	(0.222)		(0.224)	(0.234)
Trust measured				0.217				
in region of operation				(0.167)				
Inherited Trust						-0.111***		
						(0.042)		
Observations	69,912	51,070	49,174	47,692	49,160	49,160	49,160	41,976
Firm-level controls (4)	No	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country-level controls (5)	No	No	No	No	No	No	Yes	No
Year dummies (10)	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies (35)	No	No	Yes	Yes	Yes	Yes	Yes	Yes
Country of operation dummies (24)	No	No	Yes	Yes	Yes	Yes	Yes	No
Region of operation dummies (103)	No	No	No	No	No	No	No	Yes
Clustering	Country	Country	Country	Country	Country	Country	Country	Region
Number of clusters	25	20	20	20	20	20	20	93

Notes: The dependent variable in all columns is the binary noncompliance measure that takes 1 if the installation is out of compliance and 0 otherwise. The sample in this table includes multinational firms only. Standard errors are clustered at the level shown in each column. "Industry dummies" are based on the main activity type information provided in the European Transaction Log. Column (1) does not include any controls and column (2) adds firm-level controls (number of installations each firm owns, total assets, operating revenue, and number of employees). Column (3) includes year, industry and country of operation fixed effects. Column (4) separately checks the influence of trust in the region where the installation is located. Column (5) instruments the trust variable with a measure of inherited trust and column (6) shows the reduced form relationship between noncompliance and the instrument. Column (7) further includes time-varying country-level controls and column (8) includes region fixed effects. * significant at 10%, ** significant at 5%, *** significant at 1%.

Table 2.5: Trust and Noncompliance in the EU ETS between 2005 and 2015: Robustness Checks

	Dependent variable: Indicator for noncompliance							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Estimation method	IV Probit	IV Probit	IV Probit	IV Probit	IV Probit	IV Probit	IV Probit	Probit
Trust measured	-0.598***	-0.609**	-0.398*	-0.602***	-0.615***	-0.599**	-1.064*	
in country of central headquarter	(0.223)	(0.249)	(0.219)	(0.222)	(0.230)	(0.241)	(0.562)	
Inherited Trust								-0.113***
								(0.044)
Observations	46,257	47,570	49,204	48,921	49,160	49,160	49,160	49,160
Firm-level controls (4)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region-level controls (3)	Yes	No	No	No	No	No	No	No
Country of operation dummies (24)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies (10)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies (35)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clustering	Country	Country	Country	Country	Country	Country	Country	Country
Number of clusters	20	18	20	20	20	20	20	20
First stage F stat	172.7	191.9	179.8	187.1	194.0	218.7	21.2	

Notes: The dependent variable in each column is a binary noncompliance measure that takes 1 if the installation is out of compliance and 0 otherwise. Standard errors are clustered at the level shown in each column. "Industry dummies" are based on the main activity type information provided in the European Transaction Log. Column (1) includes region-level controls and column (2) drops ETS late joiners in my sample (Bulgaria and Romania). In column (3) and (4) I use alternative specifications for the binary compliance variable. In column (5) and (6) I try alternative measures of trust to check for potential measurement error (detailed explanations in the main text). In column (7) I try an alternative instrument and column (8) shows the reduced-form relationship between noncompliance and the alternative instrument. * significant at 10%, ** significant at 5%, *** significant at 1%.

Table 2.6: Bilateral Trust and Noncompliance in the EU ETS between 2005 and 2015

	Dependent variable: Indicator for noncompliance			
	(1)	(2)	(3)	(4)
Estimation method	Probit	Probit	IV Probit	IV Probit
Bilateral trust	-0.007	-0.059	1.717	0.623
	(0.254)	(0.260)	(1.536)	(0.804)
Observations	12,292	9,199	7,696	7,696
Firm-level controls (4)	No	Yes	Yes	Yes
Country of operation FE (24)	Yes	Yes	Yes	Yes
Country of HQ FE (43)	Yes	Yes	Yes	Yes
Year dummies (10)	Yes	Yes	Yes	Yes
Industry dummies (35)	Yes	Yes	Yes	Yes
Clustering	Country pair	Country pair	Country pair	Country pair
Number of clusters	125	111	77	77
First stage F stat			22.0	15.5

Notes: The dependent variable in all columns is the binary noncompliance measure that takes 1 if the installation is out of compliance and 0 otherwise. The sample in this table includes foreign MNEs only. Standard errors are clustered at the country of headquarter by country of operation (country pair) level. "Industry dummies" are based on the main activity type information provided in the European Transaction Log. I use religious similarity as an instrument in column (3) and somatic distances as well as religious similarity in column (4). * significant at 10%, ** significant at 5%, *** significant at 1%.

Chapter 3

The Effect of Internal Migration on Trust in Communities of Origin

3.1 Introduction

The literature on the consequences of migration in communities of origin has grown substantially in recent years. Migration has been shown to enhance human capital accumulation and entrepreneurship in origin households (Yang, 2008), lead to changes in intrahousehold resource allocation and increase educational expenditures on girls relative to boys (Antman, 2011). Further, labor migration also appears to have long run effects on origin communities by raising the level of educational attainment of the next generation (Dinkelman and Mariotti, 2016), although there is evidence for its short-run negative effects on labor supply, income and durable assets (Gibson et al., 2011). However, existing research has a particular focus on the effects of migration on human and physical capital investment mostly through remittances and has paid relatively little attention to the social aspects of migration in communities of origin. In this paper, I turn my attention to this largely underexplored dimension of the dynamics of migration and provide evidence that there exists a *social* cost associated with migration in origin communities: reduced trust among the remaining population.

It is plausible that migration may affect how much neighbors trust each other since out-migration simply reduces the pool of local residents whom one trusts. Or indirectly, it is also likely that in-migration may lead to lower levels of trust through increased population density and urbanisation, which is typically associated with greater anonymity (Miguel et al., 2005). However, a rational-choice account of trust developed by Hardin (2002) that requires two essential elements, knowledge to allow the truster to trust and incentives of the trusted to fulfil the trust, suggests a more nuanced channel for the potential impact of migration on trust among neighbors, namely, the incentives to invest in social capital, which is the focus of the current paper.

To explain, one can hypothesize that high migration rates in a neighborhood lowers the incentive to get to know each other (which is a basic form of social capital investment), which will allow residents to learn the trustworthiness of their neighbors, due to the short expected time period over which they would interact. This corresponds to the first element in the rational choice account of trust that concerns the truster's incentives. Similarly, concerning the second element, the expected short-term nature of the relationship may also reduce the incentives to be trustworthy when trusted by weakening the threat of punishment or of developing bad reputations because such threats are based on the expectation of on-going relationships. This incentive problem is critically described by Hardin (2002):

> *The biggest and most pervasive problem for us in trusting others is not the malign problem of dealing with cheaters but the relatively neutral problem of often having to deal with people with whom I cannot expect to have ongoing relationships in which to ground incentives for trustworthiness.*

Moreover, there exists a strategic complementarity between the two elements. Individuals may not attempt to get to know their neighbors and form opinions on their trustworthiness *in response to* the low anticipated incentives of their neighbors to be trustworthy in areas characterised by high out-migration (Sobel, 2002; Miguel et al., 2005). This incentive problem is based on the expected short-term nature of the relationship with one's neighbors, which arises primarily from out-migration than from in-migration. Therefore, I mainly focus on the effects of out-migration in this paper.[1]

Trust shared among neighbors plays two key roles in developing countries. Firstly, it has been shown that trust facilitates collective action in the absence of external enforcement. Ostrom (1990) documents a wide range of empirical evidence that contrary to the conventional collective action theory, individuals often cooperate to sustainably manage local natural resources under some circumstances. One of the central characteristics of the cases of successful cooperation is trust between involved parties, or the capability of group members to gain a reputation for being trustworthy (Ostrom, 2000; Milinski et al., 2002; Poteete et al., 2010). It is then likely that high out-migration may have negative impacts on a community's capacity for collective action by disrupting the formation of trust among residents.

[1]The incentive problem may also arise in the context of high in-migration if migrants are ethnically and linguistically distinct and therefore existing residents feel less inclined to socialise with the newcomers (Alesina and La Ferrara, 2000; Miguel and Gugerty, 2005), thus affecting the first element of the rational choice account of trust. However, I am not able to explicitly investigate the dynamic arising from racial or linguistic diversity in my analysis as Mexico is relatively ethnically homogeneous with over 60 percent of the population being Mestizo, around 30 percent indigenous. International migrants coming to Mexico are also small in numbers under strict immigration laws in Mexico (Gonzalez-Murphy and Koslowski, 2011).

Secondly, several studies document that local social capital provides access to credit or informal risk-sharing mechanisms in the absence of formal insurance markets. For example, Fafchamps and Lund (2003) provide evidence in the context of rural Philippines that informal credit allows households to share risk within their social networks that are formed and sustained by social capital. Udry (1990) shows that poor villagers in Nigeria experience a dense network of loan exchanges with almost all of these loans taking place between neighbors and relatives. Munshi and Rosenzweig (2009) argue that the same process happens in India through the *jati* or subcaste networks. Therefore, it is imperative that we understand what affects the level of trust or social capital shared among neighbors, given its prominent effects on the welfare of households in developing countries.

To estimate the causal effects of migration on trust, I combine the household level trust measures from the Mexican Family Life Survey (MXFLS) with the aggregate migration rate at the municipality level in Mexico. Internal migration in Mexico has been a common phenomenon since the mid-20th century and contributed to the rapid growth of urban centers while bringing substantial changes in social and demographic composition of both destination and source areas (Cohen et al., 2003). Thus it provides an ideal setting to investigate the changes in trust with respect to internal migration flows. The panel nature of the MXFLS makes it possible to control for time-invariant omitted variable bias, thus overcoming some of the econometric limitations of the few existing studies on the determinants of trust that include migration.[2] However, even when unobserved household heterogeneity is effectively controlled for by the first-difference specification, there still remain major identification concerns, namely, time-varying omitted variable bias and reverse causality. To deal with these issues I use a set of 'pull' factors to destination municipalities such as the revenue from the outsourcing industry known as *Maquiladora* and extreme weather conditions, to predict migration inflows. Next, I assign these predicted migration flows to likely source areas based on historical settlement patterns within the country, which then becomes an instrument for out-migration flows. The process of constructing instruments is explained at length in Section 3.4.2. This empirical approach allows me to address the core econometric concerns.

Based on the empirical strategy summarized above I find that residents in municipalities with high out-migration rates were more likely to experience statistically significant and negative changes in trust on their neighbors —people were more likely to adjust their trust downward —if they lived in an area with high out-migration rates in the past five years. The findings from exploring heterogeneity suggest the importance of social networks in the way migration affects trust between individuals. The adverse impact of

[2]For instance, Alesina and La Ferrara (2002) and Glaeser et al. (2002) include mobility in their studies on the determinants of trust or local social capital investment, however, they rely on cross-sectional analysis.

out-migration on trust appears to be mitigated in rural areas where pre-existing social networks are dense. I further investigate other aspects of social capital apart from trust (willingness to help and value sharing) in order to demonstrate that internal migration significantly affects local social capital at large including trust among residents.

I strive to contribute to two different strands of literature. Firstly, the paper links to the vast literature on the development implications of migration in source communities. Existing research has investigated a wide range of outcomes including income, health, human capital investment, and entrepreneurship. In terms of income and poverty, studies have shown mostly positive effects of migration through remittances on households in sending communities (see Page and Adams (2003) for a review). A large number of papers have also studied the effects of migration on human capital investment and found ambiguous results. Some document that remittances relax credit constraints, thereby directly reducing barriers to schooling (Yang, 2008; Page and Adams, 2003). On the other hand, higher expected wages of migrant jobs may undermine human capital accumulation by encouraging early school drop-out (De Brauw and Giles, 2016; Gibson et al., 2011; McKenzie and Rapoport, 2011). With regard to health outcomes, studies have found largely positive effects of migration in origin areas such as lower infant mortality (Hildebrandt et al., 2005) or higher weight- and height-for age (Acosta et al., 2007). Surprisingly, however, there has been a lack of attention to the social dimension of this dynamic phenomenon.[3] This paper complements the literature by focusing on this hitherto neglected area of interest by providing empirical evidence that migration could entail a social cost in origin communities in the form of reduced trust shared by neighbors.

Secondly, given the mounting evidence of the importance of trust among individuals, my contribution here is in helping to understand what forms and affects trust.[4] There are studies that emphasize historical determinants of differences in trust such as religion, and genetic and somatic similarities in the indigeneous population (Guiso et al., 2009), climate variability (Durante, 2010) and historic events (Nunn and Wantchekon, 2011). However, this paper directly complements studies that focus on non-historic and more

[3]A remotely related literature to the current paper may be the growing literature on the social ramifications of international migration, namely, the transmission of values and norms across borders. Bertoli and Marchetta (2016) find that Egyptian households where the husband is a returnee from a high-fertility country (such as Arabic countries) tend to have a larger number of children than households where the husband had no such cultural exposure. Lodigiani and Salomone (2012) provide evidence that international migration increases female parliamentary representation in source countries when migration is directed toward countries with a higher female political empowerment. Spilimbergo (2009) shows that student migration toward democratic countries promotes democracy at home. Adding to this growing literature, I find evidence that internal migration could also bring about social changes in origin communities in the form of reduced trust shared by neighbors.

[4]Recent studies document the importance of trust; for economic development (Knack and Keefer, 1997; Fafchamps, 2006; Tabellini, 2010; Algan and Cahuc, 2010); for international trade (Greif, 1989; Guiso, Sapienza, and Zingales, 2007a); for political institutions (Putnam, 2000); for firm management practices (Bloom, Sadun, and Van Reenen, 2008); for informal risk-sharing (Fafchamps and Lund, 2003, Attanasio et al. 2012); for collective action (Bouma et al., 2008, Ostrom, 1990); for cooperative behavior in the international arena (Carattini and Jo, 2018); and for firms' complicance decisions (Jo, 2018).

local determinants of interpersonal trust. Karlan et al. (2009), Binzel and Fehr (2013) and Feigenberg et al. (2013) show the importance of dense social networks and frequent interactions in fostering trust between individuals. Bellows and Miguel (2009) show that violent experience such as war is negatively correlated with local social capital. At the individual level, Alesina and La Ferrara (2002) and Glaeser et al. (2002) document a set of factors that explain individuals' social capital including income, education and experience of discrimination.

The remaining part of the paper is structured as follows. In Section 3.2, I explain the conceptual framework behind the analysis in more detail. Section 3.3 provides data descriptions and Section 3.4 explains the empirical strategy with an emphasis on how to construct the predicted migration flows for instruments. In section 3.5, I report the estimates, discuss the findings, and explore heterogeneity. Secion 3.6 concludes.

3.2 Conceptual framework

The notion of trust that I investigate in this paper is taken from Hardin (2002)'s rational-choice account of trust, which is the result of cognitive assessments of the trustworthiness of the (potential) trusted and of the returns to being trustworthy when trusted. This is different from the concept of generalized trust —the expectation that a random member of an identifiable group is trustworthy (Guiso et al., 2009) —to which most of the economics literature relates. Generalized trust constitutes a culture or norm in the sense that it goes beyond one's knowledge or incentives to be trustworthy (Guiso et al., 2015a). To say one has high generalized trust or one lives in a society with high generalized trust is to say that she is likely to trust someone with whom she is not necessarily familiar or of whom she might not possess much prior knowledge. Thus what I investigate here is trust that is relational in that it involves two parties, truster and trusted, and cognitive as opposed to dispositional. Within this conceptual framework, the hypothesis I test is whether migration adversely affects the assessment of trustworthiness of individuals (who could be potentially trusted) in one's community and lowers the incentive to fulfil the trust once trusted.

Migration could negatively affect trust between individuals through lower investment incentives in social capital. For example, if we plan to migrate or we anticipate that our neighbors will move out of our neighborhood in the near future, we might not invest too much time getting to know them, which will not allow us to assess their trustworthiness. A study on the impact of homeownership on social capital investment by DiPasquale and Glaeser (1999) illustrates this point. They find that renters, compared to homeowners, tend not to invest in social capital since they will not stay long enough to gather the returns from the investment. Renters are associated with fewer local organizations, less likely to be involved in local politics and less likely to put effort in gardening, which

is a local public good. They find evidence that a sizeable share of the estimated effect of homeownership comes from their lower mobility rates. Glaeser et al. (2002) report similar findings that an individual's predicted mobility (based on age, marital status and the number of children) is negatively associated with social capital investment.

It is also plausible that high out-migration rates in a neighborhood lowers the incentive to be trustworthy when trusted by weakening the threat of punishment or of developing bad reputations because such threats are based on the expectation of on-going relationships. This conjecture is consistent with the insight from the repeated games literature that asserts a cooperative equilibrium is sustainable in an uncooperative game when the game is infinitely repeated and players discount the future sufficiently little (Maskin and Fudenberg, 1986). Dal Bó (2005) specifically provides experimental evidence that the prospect of future interactions significantly reduces opportunistic behavior and supports cooperation. The fear of retaliation is also relatively low in an environment characterised by high migration rates. A relevant example is provided by studies that investigate the functioning of rotating savings and credit groups (known as Rosca). These informal financial institutions are formed and administered on the basis of mutual trust, since those who contribute money to the common fund today must have sufficiently high confidence that other members will also contribute to the fund and they will be repaid in the future.[5] However, when the probability of migration is high among group members, the informal social sanctioning mechanisms and trust that sustain the credit groups become less effective and cooperation could easily unravel (Besley et al., 1993; Routledge and Von Amsberg, 2003).

One important observation to make is that the two elements discussed above, knowledge of the truster and the incentive of the trusted to be trustworthy, are complements. Residents may not attempt get to know their neighbors and form opinions on their trustworthiness *in anticipation* of their neighbors' low incentives to be trustworthy given the expected short-term nature of their relationship. Or having no knowledge at all about neighbors and consequently very weak interpersonal relationships in the neighborhood do not allow the opportunity to assess whether it is profitable to be trustworthy since it is likely that there is no trust placed on them in the first place. A similar observation has been made by Sobel (2002) with regard to local organization memberships (which is often a proxy for individuals' social capital) who said, there needs to be clubs in order for an individual to join one.

My analysis aims to subject this socioeconomic view on trust as a rational choice to rigorous econometric investigation and to estimate the causal effects of migration on trust among neighbors. I then further investigate the more detailed workings of the incentive channel explained above by exploring potential mechanisms and heterogeneity of the estimated effects.

[5]See Phillipe Callier (1990) for an economic interpretation of Roscas.

3.3 Data description

To investigate the effects of migration on how much individuals trust each other, I combine aggregate data on migration rates at the municipality level from the 2010 census with household level trust beliefs data from the Mexican Family Life Survey.

3.3.1 Internal migration in Mexico between 2005 and 2010

The 2010 Mexican Population and Housing Census collected by the Mexican National Statistics Institute (INEGI) contains rich information for 2.9 million households (10 percent of the total population) on household assets, employment, food security, education and health care among many other variables. Most importantly, it asked respondents to report both their place of residence in 2005 and their current location in 2010. I use this information to construct 5-year internal migration flows at the municipality level. That is, I calculate the number of migrants leaving (arriving in) a municipality between 2005 and 2010 as a share of the existing population to obtain the out (in-) migration rate of the municipality. Table 3.1 presents summary statistics for migration rates at the municipality level for 2404 municipalities for which both in- and out-migration rates could be constructed.[6] The mean out-migration is slightly lower than 4 percent whereas the mean in-migration rate is around 4.5 percent. In my main analysis I do not consider international migrants and focus on internal migration because the novelty of my identification strategy is to exploit economic fluctuations in a domestic industry (the maquiladora sector in Mexico) as a main pull factor for internal migration flows as will be explained in detail later. The analysis in this paper then provides a lower bound, given the prevalence of Mexican migration to the United States, for the effects of out-migration on trust beliefs. However, when I include international migrants in the out-migration rate as a sensitivity check the results are qualitatively similar.

[Figure 3.1]

Internal migration in Mexico has been a common phenomenon since the mid-20th century and contributed to the rapid growth of urban centres while bringing substantial changes in demographic composition of both destination and source areas (Cohen et al., 2003). Thus it serves as an ideal setting to investigate the changes in trust with respect to internal migration flows. Panel A and Panel B in Figure 3.1 graphically show the

[6]There are 2456 municipalities and 32 states in Mexico, however, the number of municipalities within states varies substantially across states. For instance, the state of Oaxaca has 570 municipalities while states such as Baja California and Baja California Sur has five municipalities. Thus, for some very small municipalities, even census data does not provide reliable migration rates. Dropping those 52 municipalities with either missing migration data or unreliable measures of migration rates yields population flows for 2404 municipalities.

internal in- and out-migration rates, respectively, at the municipality level. It is readily observed from Panel A that municipalities along the northern border with the United States have higher in-migration rates. On the other hand, out-migration rates seem to be more evenly distributed across the country, but some urban centres or municipalities with high in-migration rates also display high out-migration rates, which indicates the popular pattern of urban-urban migration in Mexico (Villarreal and Hamilton, 2012).

[Table 3.1]

3.3.2 Trust

For trust data I turn to the last two waves of the Mexican Family Life Survey (MXFLS) conducted in 2005 and 2009.[7] The survey is a collaborative project managed by researchers in Mexico and the United States and is designed to be nationally representative. Most importantly for the purpose of the current study, the survey includes a set of questions, trust being the main variable of interest, that reflect various aspects of social capital at the community level. These questions are answered by household heads or someone older than 18 who are knowledgeable about their own households (enough to answer questions related to household economy).[8] There are 7,483 households interviewed in both waves but dropping 246 households that moved all together to a different municipality yields 7,237 panel households in 165 municipalities. Additional 1,079 observations are lost because of missing information on trust and other household characteristics. My final reference sample for the baseline specification thus consists of 6,158 households in 152 municipalities. Table 3.1 shows summary statistics for trust and other household characteristics for this sample.

The MXFLS elicits trust by asking the respondent to answer how much they agree with the following statement "People from this locality/community are trustworthy", for which they can choose between "Completely Agree", "Agree", "Disagree" or "Completely Disagree". This question is slightly different from the classical trust question in several popular surveys such as the World Values Survey and the European Social Survey that has been extensively used to study the effects of trust. However, I argue that this dif-

[7]The survey started in 2001 and so far three waves have been conducted. However, only the last two waves include questions related to neighborhood social capital including trust. The dataset is publicly available at http://www.ennvih-mxfls.org/.

[8]The question being asked at the household level raises the concern of measurement error for it is then possible that different respondents answered this question across the two waves and consequently the change in trust simply reflects the change in respondents within the family. To the extent that the identity of the respondents differed across years due to migration of the previous respondent, this measurement error might be positively correlated with the municipality-level migration rate – the explanatory variable of interest – which makes it endogenous. I explain my identification strategy that relies on instrumental variables to deal with endogeneity concerns in Section 4.

ference makes the question in the MXFLS more suitable for the purpose of the current paper due to its wording and location. To explain, the classical question is the following: "Generally speaking, would you say that most people can be trusted, or that you can't be too careful in dealing with people?" While this question asks respondents how much they trust *most* people, which could mean anyone from their family members to complete strangers, the question in the MXFLS restricts the pool of people to those in their neighborhoods, which arguably better reflects the component of local social capital. Furthermore, the location of the trust question in the MXFLS is among a set of questions on their neighborhoods, whereas the classical trust question in other surveys is asked along with personal questions such as subjective well-being and happiness. Consequently, the MXFLS provides a relatively clear measure for trust held by individuals as an aspect of local social capital, rather than individual characteristics. This is an advantage of using this dataset to study trust between individuals with respect to aggregate characteristics (migration rates at the municipality level in this study) and to the best of my knowledge the question on the impact of migration on trust has not yet been rigorously investigated.[9] The MXFLS provides a valuable tool for investigating this question.

A number of papers have confirmed that survey-based trust measures are indeed correlated with trusting behavior. Fehr et al. (2003) show that survey questions of this type do capture trust by running a series of experiments, and Fehr (2009) further demonstrates that the survey measure of trust is strongly correlated with the behavioral measure of trust derived from trust games.[10] On the contrary, Glaeser et al. (2000) provide experimental evidence that the survey question captures the trustworthiness of respondents rather than trust; but, this conflicting finding has been reconciled by Sapienza et al. (2013) who show that subjects in a homogeneous sample (such as Harvard undergraduates as in Glaeser et al. (2000)) tend to extrapolate the trustworthiness of others based on their own trustworthiness. However, in a large anonymous sample (such as random individuals in Germany as in Fehr et al. (2003)) in which respondents are not extrapolating expected trustworthniess of others based own their own trustworthiness, the survey question does seem to capture trust. Thus I believe the trust measure from the MXFLS is appropriate for the purpose of my analysis that strives to investigate whether migration

[9]Individual mobility has been shown to be negatively associated with investment in social capital (Glaeser, Laibson and Sacerdote, 2002 and DiPasquale and Glaeser, 1999). Alesina and La Ferrara (2002) investigate various individual and community characteristics that influence trust beliefs in a cross-sectional analysis and find a weak association between migration inflows and trust beliefs held by existing residents.

[10]In a typical trust game used in the literature, subjects are paired and one member of the pair (the sender) has the opportunity to send some amount of money to his or her partner (the recipient). The experimenter doubles the amount that is sent. After the second player receives the transfer (i.e., twice the amount sent), he or she may return money back to the first player. Here, the amount sent by the "sender" becomes a natural measure of trust as the sender trusts the "recipient" to return a fair share of the amount the recipient receives. Similarly, controlling for the amount sent, the amount returned is a measure of trustworthiness.

affects trusting behavior of individuals in origin areas.[11]

[Figure 3.2]

Figure 3.2 shows a negative correlation between trust in neighbors and out-migration rate at the municipality level in 2009. Municipalities with high out-migration rates tend to display lower levels of trust, which is consistent with the argument presented in Section 3.2. The correlation is statistically significant at 1 percent level. This casual inspection provides suggestive evidence for the effect of out-migration on trust among neighbors, which warrants a more rigorous investigation.

3.4 Identification strategy

3.4.1 First-difference specification

In this section I attempt to identify the effect of out-migration at the municipality level on how much residents trust each other. The baseline specification is in first-differences in order to account for unobservable household heterogeneity correlated with trust and to exploit the panel nature of the dataset. Let $\Delta Trust_{ijs}$ be the change in trust beliefs between 2005 and 2010 of a family i in municipality j, state s. Then I posit that $\Delta Trust_{ijs}$ will be a function of the migration rates at the municipality j over the same time period along with a vector of the changes in several household characteristics between 2005 and 2010, ΔX_{ijs} and state-specific time trends K_s:

$$\Delta Trust_{ijs} = \alpha + \Gamma' \Delta X_{ijs} + \beta OM_{js,05-10} + \delta K_s + \epsilon_{ijs} \tag{3.1}$$

where $OM_{js,05-10}$ represents the out-migration rate from municipality j. In the Appendix I also investigate the effects of the net- and in-migration rate, $N_{js,05-10}$, $IM_{js,05-10}$, to investigate the differential impacts of population inflows and outflows. The first-difference specification is particularly relevant when we consider that trust held by individuals at one point is an equilibrium level reached by past experience, thus should be interpreted as a stock variable. Thus the migration flows between 2005 and 2010 should affect the *change* in the residents' trust that took place over the same time period rather than an equilibrium outcome observed at one point in time. This specification also accounts for time-invariant municipality characteristics as the respondents were interviewed in the same residence in both waves. I later also include time-varying municipality-level controls

[11] Studies that investigate the effect of trust on a variety of economic outcomes (cited in Footnote 4) also typically rely on this kind of survey-based trust measures.

as sensitivity checks.[12]

The vector of relevant households characteristics that can explain trust, ΔX_{ijs}, include the age and education of household head, household income, the presence of children younger than 10 years old, household size and homeownership. Income and education have been shown to positively affect trust in the literature (Alesina and La Ferrara, 2002). The children variable captures the idea that having to look after young children significantly reduces the parents' opportunities for social interaction and also that the presence of children at home might make one feel more cautious about the security of one's neighborhood. Both scenarios may lead to lower trust beliefs towards people in the neighborhoods. The homeownership variable is also included as it has been documented to have strong effects on individuals' social capital investment (DiPasquale and Glaeser, 1999).

Standard errors are clustered at the municipality level to correct for potential correlation in shocks faced by households in the same municipality.[13]

3.4.2 Developing an instrument for migration rates

Two main threats to the above specification are potential time-varying omitted variable bias and reverse causality. There might be time-varying factors that simultaneously affect aggregate migration rates and trust held by residents such as improvements in infrastructure including road, bridges and telephone lines. This could render social interactions more convenient and migration less costly through information flows and network building (e.g. Munshi 2003; Mckenzie and Rapoport 2007). In this case the estimates would be driven upward. At the same time, it might be the changes in trust held by residents that drove people out of their municipalities and thus explain migration flows, not the other way around, if people choose to move to a different municipality based on how trusting their neighbors are (for instance, people might be motivated to migrate when they sense that people in their neighborhood do not trust each other). In this case the estimates are downward biased. Thus the sign of the potential bias is uncertain. In order to deal with these identification issues, I use an instrumental variable approach largely based on the idea developed in Boustan et al. (2010).[14]

To develop instruments for out-migration, the standard economic model of migration

[12]I do not include these municipality-level controls in my baseline specifications as they reduce the sample size substantially. However, as will be shown in robustness checks, my findings are robust to the inclusion of these controls and the subsequent change in the sample size.

[13]Boustan, Fishback and Kantor (2010) weights their regression in such a way that each area contributes equally to the estimation since they attempt to estimate the impact of mobility on a local labor market. On the other hand, the goal of my analysis in this paper is to estimate the impact of mobility on *households*' incentive to invest in social capital and as such it is primarily disaggregate-level analysis, thus I do not weight the regression.

[14]This idea of using predicted migration rates to instrument actual migration rates has been exploited by several papers including Strobl and Valfort (2015) and Maystadt, Mueller and Sebastian (2015).

with push and pull factors is employed. Prospective migrants from a source area j compare the expected benefits of moving to new locations k with the costs of migration (Sjaastad, 1962). While negative economic shocks driving migrants out of source area j are clearly endogenous with respect to the level of trust or social capital at large in that area, positive economic conditions pulling migrants to destination area k (out of j) are arguably exogenous to trust beliefs held by residents in j. Therefore, local economic conditions in areas that typically pull migrants out of source area j are natural instruments for out-migration out of that city.

For local economic conditions, I use revenue from the outsourcing industry known as *Maquiladora* in Mexico. A maquiladora is a manufacturing plant that imports certain materials and equipment on a duty-free and tariff-free basis for assembly, processing, or manufacturing and then exports the assembled, processed and/or manufactured products. The demand for low-skilled labor in maquiladora operations has been a notable pull factor for internal migration within Mexico in the past several decades (Villarreal and Hamilton, 2012; Portes and Roberts, 2005). A strength of this approach is that the revenue in the maquiladora sector provides a potentially more exogenous variation for internal migration flows than other measures commonly used in the literature such as overall GDP or employment growth rates in destination areas because the fluctuations in this industry are determined outside of Mexico by foreign markets that these assembly plants serve (Bergin et al., 2009). This feature makes it less likely that the labor demand shocks in this sector were correlated with local social capital in Mexican communities. I rely on the Economic Census 2004 and 2009 published by the Mexican National Statistics Institute (INEGI) for municipality-level revenue data from the maquiladora sector use the change in revenue between 2004 and 2009 to predict migration flows between 2005 and 2010.

Along with economic conditions, I also use extreme weather conditions and an indicator for rural areas to further predict the migrant inflows (outflows) to destination areas (from source areas) as in Boustan et al. (2010). Previous papers have also used temperature variations to instrument migration flows in Mexico (e.g. Munshi, 2003) as well as in other contexts (Feng et al., 2012; Gray and Mueller, 2012) and it is expected that people are attracted to areas with favorable weather conditions and driven out of areas with negative weather shocks. The weather data come from Cohen and Dechezleprêtre (2015) where they match the centroid of each municipality with the nearest land-based weather station. Extreme weather conditions are defined as the deviation (measured in days) from the average number of days with temperature over 32 or below 10 degrees.[15] The dummy variable for rural areas is meant to capture the idea of differential patterns of migration between urban and rural areas.

The predicted migrant inflows for each destination area are then distributed over pos-

[15]The climate data is provided by the National Climatological Database of Mexico which is based on around 5,500 operating and formerly operating land-based stations in Mexico.

sible source areas using settlement patterns observed between 1995 and 2000 constructed based on the 2000 Mexican Population and Housing Census. By using settlement patterns observed 10 years ago I assume that they are a reasonable predictor of future settlement patterns (Theoharides, 2017; Munshi, 2003).[16] I avoid using the actual settlement patterns between 2005 and 2010 as it may be correlated with time-varying unmeasured municipality characteristics (Boustan et al., 2010).

The maintained identifying assumption is that the variables used to predict in-migration to destination areas are uncorrelated with unobserved characteristics related to trust beliefs held by residents in source areas. The main threat comes from the possibility of spatial correlation. In this regard, I argue that the revenue in the maquiladora industry in destination areas provides a plausibly exogenous variation (with respect to the level of trust shared in communities of origin) given the geographical disconnect that involves international borders between where the variation is generated (outside of Mexico) and where the outcome of interest is observed (local Mexican communities). Still, the above identifying assumption can be violated, given that weather fluctuations are likely to affect neighboring municiaplities simultanesouly and many internal migrants relocate over short distances. 48.3 percent of cross-municipality moves between 2005 and 2010 in my sample took place within the same state. Therefore, following Boustan et al. (2010) I construct my instrument using predicted migrant inflows from source areas outside of the destination area's own state in order to minimize the possibility of spatially correlated shocks. Later I also try to exclude migrants who moved out of one's own state but moved to municipalities within 100km or 200km from the borders as sensitivity checks.

3.4.3 Constructing the instruments

The procedure to create the instruments for out-migration rates is as follows. For the instrument for out-migration rates, I predict in-migration rates to destination municipalities indexed by j, using local economic conditions along with weather shocks and a rural indicator. These rates are used to calculate a predicted inflow into each destination area j, out of source area k's state. Then I use internal migration patterns observed between 1995 and 2000 to estimate the probability that migrants arriving in destination area j

[16] An alternative to using historical settlement patterns is to use geographical proximity between municipalities to predict migrants' destination choices and possible source areas as in Strobl and Valfort (2015) and Boustan, Fishback and Kantor (2010). However, geographical proximity does not produce strong predictions for actual settlement pattern in my data probably because of the substantially larger sample size. Strobl and Valfort (2015) with 56 districts and Boustan et al. (2010) with 117 cities, find that the distance between these areas strongly predict the actual settlement pattern (migrants are likely to relocate to an area closer to their original area); however, the 2401 municipalities in Mexico are relatively closer to one another than those districts or cities are in the aforementioned papers. Consequently, it is likely to be much more difficult to predict settlement pattern solely based on the distance. This is also consistent with Villarreal and Hamilton (2012) where the authors document the increasingly popular urban-urban migration and migrants originating from urban areas tend to travel longer distances. In other words, these migrants do not choose their destinations based on physical distance.

come from source area k. The total predicted migrant outflow from each source municipality k is then the sum of these pair-wise predictions across all possible destination areas. This predicted migrant flow becomes my instrument for the actual out-migration rate.[17]

To explain in detail, the in-migration rate $IM_{j,05-10}$ to destination area j is a function of a vector of the changes in local economic and weather conditions (ΔZ_j):

$$IM_{j,05-10} = \alpha + \Phi' \Delta Z_j + \mu_j \tag{3.2}$$

where Z_j includes the change in revenues from the maquiladora industry between 2005 and 2010 and the number of days between 2005 and 2010 with extreme temperatures (over 32 and below 10 degrees Celsius) and a rural indicator. I estimate the parameters of equation (2) from a single equation where each observation is a destination municipality. The predicted flow of migrants coming to municipality j is the product of the predicted in-migration rate for j and the population of the area in 2005:

$$IM_j = IM_{j,05-10} \times Population_{j,05} \tag{3.3}$$

Then I use the settlement pattern observed between 1995 and 2000 to predict the source municipalities of the migrants who come to municipality j, where P_{jk} is the probability that migrants coming to j have come from source municipality k. The instrument for out-migration from municipality k is then the sum over all areas ($j \neq k$) of the predicted number of migrants who are assumed to originate from municipality k ($\neq j$). Migrants who are expected to come from municipalities in the destination j's own state are excluded in order to minimise the concern for spatial correlation.

$$M_k = \sum\nolimits_{j \neq k} IM_j \times P_{jk} \tag{3.4}$$

Finally, the instrument for out-migration rate in municipality k divides the predicted outflow by the population of that area in 2005.[18]

[Table 3.2]

[17] It has been shown (Wooldridge 2002) that standard two-stage least squares inference is valid when instruments are functions of estimated parameters. The idea is that estimated instruments simply add noice to the first-stage regression, which should not affect the inference in the second stage.

[18] The instrument for the in-migration rate to municipality j is constructed in a similar way. First, I estimate the out-migration from each source municipality as a function of local push factors including economic and weather conditions. Then the predicted rate is converted to a predicted migration outflow by multiplying by the population in 2005. Again, using the settlement pattern observed ten years ago I distribute out-migrants over possible destination municipalities in order to have the predicted number of out-migrants moving from area k to area j. Finally, summing these predicted inflows across all possible source municipalities yields the predicted migration inflows, which are then converted into a predicted in-migration rate for destination area j by dividing by the population of the area. I use this instrument in the Appendix where I explore the effects of in-migration on trust among neighbors.

Table 3.2 presents the results from the regressions that predict in and out-migration rates based on local push and pull factors. As expected, an increase in the revenue from the maquiladora sector appears to be a strong pull factor for migrants, increasing the in-migration rate by 0.06 percentage points for every one billion peso increase in the revenue. Rural areas experienced substantially lower in- and out-migration, which emphasizes the popular urban-urban migration pattern. Extreme weather conditions, both cold and hot days, do not have a significant impact on in-migrations, whereas they appear to be strong push factors that lead to higher out-migration flows. This finding is consistent with existing empirical evidence for the weather-induced migration (Feng et al., 2012; Gray and Mueller, 2012). One surprising finding is that an increase in the revenue from the maquiladora industry, a local pull factor, also induces more out-migration, although the magnitude is much smaller (0.03 percentage points for every one billion peso increase in the revenue). This could be the case if the boom in the maquiladora industry brings about overall economic liveliness, which often times accompanies inflation. This may lead to more out-migration of less well-to-do families in particular because of rising housing prices and other living costs. Alternatively, better economic conditions brought about by the maquiladora industry might have induced individuals to migrate by relaxing the liquidity constraints faced by households and consequently allowing them to finance the initial cost that migration often entails (Angelucci, 2015). Overall, I find that the revenue increase in the maquiladora industry and extreme weather conditions are strong pull and push factors, respectively, for internal migration.

3.5 Trust and migration

3.5.1 The impact of migration on trust

Having developed instruments, I then attempt to investigate the causal effects of out-migration on trust among residents. Table 3.3 presents the coefficients from the baseline first-difference specification, equation (1), and the corresponding IV specification.[19] The baseline results in column 1 indicate that out-migration is negatively correlated with the changes in trust. This finding is consistent with the hypothesis that out-migration reduces the incentives for social capital investment that leads to trust among residents since out-migration of their neighbors (both actual and anticipated based on the municipality-level migration rate) effectively lowers the expected returns from mutual trust over future time periods.

[19]Throughout the paper, the goodness of fit of the models is small as a substantial amount of variation is already differenced out according to the first-difference specification.

[Table 3.3]

Column 2 reports IV estimates controlling for household level variables along with state fixed effects. The first-stage result of the IV estimation is presented in column 3. The first-stage regression contains the full set of state dummies and exogenous variables included in the second stage. My preferred instrument excludes migrants who are expected to relocate within the same state in order to minimize spatial correlations of unmeasured socioeconomic shocks. The predicted migration rate is a strong predictor of the actual migration rate with the F-statistics around 34. The results from the IV specification remain qualitatively the same, highlighting the detrimental impact of out-migration on trust beliefs held by remaining residents. I also find a strong and negative relationship between the instrument and the change in trust beliefs in the reduced-form regression. This correlation (column 4) is consistent with the first and second stage IV estimation and provides further evidence for the social cost of internal migration in terms of diminished trust among remaining residents.

I find the IV coefficient is more negative than OLS, suggesting that the time-varying unobserved bias that simultaneously affects migration and trust dominates the concern of reverse causality. Given the direction of the bias (upward) I infer that the source of omitted variable bias affects both trust and migration positively. In section 3.4.2, I discussed that improvements in infrastructure including road, bridges and telephone lines could be one such source because they could render social interactions more convenient and migration less costly through information flows and network building (e.g. Munshi 2003; Mckenzie and Rapoport 2007). From the community-level survey included in the MXFLS, I do find some evidence for this line of reasoning. The 2009 survey shows that out of 126 municipalities, 81 municipalities have experienced improvements in highways and roads and 46 communities had telephone line constructions in the past four years.

Not only are the negative coefficient estimates of Table 3.3 statistically significant, but they are also economically meaningful. I assess the magnitude of the out-migration rate coefficient by comparing its explanatory power against other variables in the regression. To do this, I compare the out-migration rate variable with all other explanatory variables in the estimating equation (Nunn and Wantchekon, 2011). Using the estimates from column 1 of Table 3.3, and performing a standard decomposition of goodness of fit exercise, I find that out-migration accounts for around 7.8 percent of the variation explained by the set of included covariate where the variation is what remains after controlling for household fixed effects (by the first-difference specification).

It is constructive to think about how to interpret the IV estimates of the local average treatment effects in this context. The IV estimates capture the effects of migration of individuals who respond to low-skilled labor demand shocks along with extreme weather conditions. These predicted migrants may be different from the average migrants in terms

of education or job-related skills and it is plausible to think that they are likely to be low-skilled and less educated based on the shock to which they respond. Thus the IV estimates suggest the local average treatment effect of migration of less-educated and low-skilled migrants on how much residents trust each other.

3.5.2 Robustness checks

As robustness checks, I exclude migrants who moved to municipalities out of their own states but within 100km or 200km from the state border to further reduce the concern of spatially correlated shocks. Column 1 and 2 in Table 3.4 present the results with 100km cut-off and with 200km cut-off, respectively. The instruments are still strong and the results remain qualitatively similar, although with the 200km cut-off the coefficient on out-migration becomes marginally insignificant (with p-value 0.1). Column 3 and 4 reports the reduced-form coefficients of these instruments.

I further test the sensitivity of my results by including a number of observable municipality-level controls that may affect the level of trust shared by neighbors. The data comes from the State and Municipality Database System (SIMBAD) by the Mexican National Statistics Institute (INEGI). I control for the change in educational attainment of the population measured by the average completed grade, criminal activities measured by the number of registered and sentenced offences, and public expenditure of the municipality government. The specification reduces the number of municipalities to 129 since not all variables are available for all municipalities, but the coefficient on out-migration remains robust to the inclusion of these controls (column 5). I further include the number of water supply sources and of electric power services as proxies for urbanization in case it may affect the way people interact at a more substantial loss of observations, but find similar results (column 6).

So far, international migrants have been excluded in my analysis for I rely on the fluctuations in the revenue from a domestic industry (maquiladora) as the main economic pull factor for internal migration. The instrument then fails to provide meaningful variation for international out-migration flows. However, given the prominence of international migration in Mexico (the out-migration rate that accounts for international migrants increases to 4.9 percent compared to 3.8 percent of that without international migrants), I account for international migrants as another robustness check. Column 7 reports the first-difference specification with the out-migration rate variable that now incorporates international out-migrants. The results are qualitatively similar to the findings in the main analysis. To address endogeneity, I construct an alternative instrument, namely, historical migration rates at the municipality level between 1995 and 2000 that can also predict international migration flows as in several previous studies (e.g. McKenzie and Rapoport, 2011; Woodruff and Zenteno, 2007). The identifying assumption is then that

municipality-level migration rates observed 10 years ago do not affect how much people trust one another over a 10-year period, apart from their influence through migration rates between 2005 and 2010. A common concern associated with this approach is that municipalities with historically high out-migration rates are systematically different from those with low out-migration rates (Theoharides, 2017). However, such time-invariant municipality unobservables are already controlled for in the baseline first-difference specification, mitigating this concern to some extent in my context.[20] Column 8 reports the IV estimate from the regression that uses this historical migration rate instrument. The first stage is strong with F-statistics well above conventional thresholds and the results remain consistent with the findings in the main analysis. In case time-varying factors are biasing the estimate, I also try to include six municipality-level controls added in column 6 and find that the estimate is robust to these additional time-varying factors (a coefficient (standard error) of -5.48 (2.168)).

[Table 3.4]

3.5.3 Social relations and interactions as a mechanism

The conceptual framework discussed in Section 3.2 suggests that migration may negatively affect trust shared by the remaining population by lowering one's incentive to invest in social capital. This encompasses both elements of trust: knowledge to allow the truster to trust and incentives to be trustworthy when trusted. I investigate this mechanism by explicitly exploring the changes in social relations or interactions with respect to the rate of out-migration in communities of origin.

The MXFLS provides measures that reflect the strength (or frequency) of social relations and interactions at the community level by asking the following questions: "How often do people from your community do favors to each other?", "When a neighbor is away, how often do you or your neighbors watch his/her house?", "How often do you and other people from your community ask for advice to each other about things like raising your children or getting a new job?", "How often do people from your community have parties in which you invite other people from the community?", and "How often do you

[20] This raises the question of whether it would be simpler to use this historical migration rate instrument in the main analysis. However, the 10-year gap between the historical and current migration rates here is much shorter than 70- and 90-year gap imposed in McKenzie and Rapoport (2011) and Woodruff and Zenteno (2007), respectively, and thus likely to be more vulnerable to the concern of time-varying factors affecting migration patterns in 2000 and trust in 2009 simultaneously. Unfortunately, 2000 was the first year in which the Mexican Population and Housing Census asked residents of their origin municipalities (only the question of their origin states was asked before then), so it is not possible to construct municipality-level migration rates before 2000. Thus I do not rely on this instrument in my main analysis and in this additional specification I tried including a large set of time-varying municipality-level controls to address this concern to some extent.

and other people from your community gather in each other's houses or on the street?". Respondents answer the questions by choosing from "Never", "Rarely", "Frequently" or "Always". I include the same set of exogenous controls and instruments used in the main specification.

In the data, I find evidence for the mechanism put forward so far. People who live in municipalities with high out-migration rates in the past five years appear to be less favorable to each other (column 2) and spend less time socializing (column 5). Although not always significant, the coefficients on the migration rate are negative across all the dependent variables. This result provides suggestive evidence for the investment channel behind the estimated relationship between trust and migration in communities of origin.

[Table 3.5]

3.5.4 Exploring heterogeneity

Up to this point, I have argued and presented evidence that migration affects trust through lower investment incentives in social capital. Another possibility is that the negative impact of out-migration on trust is simply driven by the loss of direct contact; in other words, people might reduce their trust on neighbors simply because people whom they used to trust have migrated. This effect is supposed to be stronger in rural areas as people have denser social networks than in urban areas (Angelucci et al., 2009) and subsequently the probability that high out-migration rates mean a loss of friends and neighbors is higher. Thus it is of interest whether the effects of migration were larger in rural areas since the difference would be indicative of the extent to which the negative impact is driven by the loss of contact.

In column 1 of Table 3.6, I show the same first-difference estimate from the entire sample reported in Table 3.3 for ease of comparison. When I restrict my sample to households in urban areas I still find a statistically significant impact of out-migration on trust (column 2). The IV estimate corroborates the result from the baseline specification (column 3). On the other hand, the effect disappears once the sample is restricted to households in rural areas (column 4). When instrumented with the predicted out-migration rate in column 5, the estimate becomes negative, but is still noisy with large standard errors. One potential reason is that there might not be enough variation in out-migration rates across rural areas, given the substantially lower out-migration rates in rural Mexico (0.036 percent in rural as opposed to 0.062 percent in urban areas). I have observed this pattern in Table 3.2 that shows a negative and statistically significant coefficient on the rural indicator for both out- and in-migration rate. Also, the weak first stage (with F-statistics just over 4) raises the question of the validity of my instrument for rural areas. It is pos-

sible that the instrument does not work well for rural areas since the instrument excludes migrants who move within their own states and that rural migrants tend to migrate over shorter distances than urban migrants do (Villarreal and Hamilton, 2012). I have tried an alternative specification of the instrument that does not exclude within-state migrants, but the first-stage F-statistics improves only slightly with no significant change in the estimated coefficient (not reported). Alternatively, I also try the historical migration rate instrument used in one of the robustness checks in Section 3.5.2 (in column 8 in Table 3.4). The first stage improves to around 10, but the estimate yields a qualitatively similar interpretation that the effect of out-migration on trust is larger for urban households, which provides evidence against the alternative hypothesis that the estimated effects hinge on losing direct contact.

It is noteworthy that the estimated effects of migration on trust appear to be missing in rural areas suggesting that the investment channel is also weaker. One explanation is that the threat of social sanctions for not fulfilling the trust is stronger when social networks are dense (Miguel and Gugerty, 2005; Hoff et al., 2011; Zak and Knack, 2001; Granovetter, 1985). Reputations also spread quickly within tight-knit groups, allowing for more effective sanctions against those who break norms. Consequently, the likelihood of opportunism (of not returning the trust of someone when given it) in anticipation of a short-term relationship is likely to be lower in rural areas, due to the strong threat of punishment from the common social network that remains even in the event of the truster's migration (Lyon, 2000; Granovetter, 1985). Thus the embeddedness of residents might serve to weaken the incentive channel put forward so far that appears to drive the findings. Descriptive statistics on social relations and interactions (explored in Section 3.5.3) in urban and rural areas in Table C.1 supports this line of reasoning. Households in rural areas tend to do each other favors more often, provide support/advice more often, and spend more time socializing with their neighbors, which suggests a deeper level of social embeddedness in those areas than in urban areas (with the difference in means across the two groups significant at 1 percent level in all five variables).

[Table 3.6]

3.5.5 Other aspects of local social capital

I further investigate whether migration had similarly affected other measures of social capital apart from trust. The MXFLS allows this further investigation as it asked respondents additional questions regarding their neighborhoods, namely, whether people around here are willing to help their neighbors and whether people from this neighborhood share the same values. Again, respondents chose between "Completely Agree", "Agree", "Dis-

agree" or "Completely Disagree" for the above questions.[21] Table 3.7 reports the results from the preferred IV specification with predicted out-of-state migration flows as instruments for each of these additional measures of local social capital. The regressions include baseline household level controls and the full set of state dummies.

[Table 3.7]

The out-migration variable is negative in all specifications and the negative effects are strongly significant on people's willingness to help neighbors and on the extent to which neighbors share the same values. Moreover, I create an all-encompassing measure of local social capital to find further evidence for the effects of migration on social capital (part of which is trust belief) by using the principal component analysis (PCA) to create an index based on the three questions used so far (trust, willingness to help and value sharing). The approach is meant to extract the primary components that underlie all the variables included in the analysis. The estimate suggests qualitatively identical results compared to the previous specifications that suggests negative and strongly significant effects of out-migration on social capital among the remaining population (column 3). Again, reduced-form equations (panel 2) provide further evidence for strong causal effects of mobility on local social capital. Table C.2 reports the results from split samples on rural and urban households for each of the outcome variables. The exercise also reveals that the estimated negative effects are much more pronounced in urban areas and adds support to the investment incentive channel.

3.6 Conclusion

This paper contributes to the growing literature that attempts to understand the determinants of trust by investigating the impact of internal migration on trust between individuals. By doing so, I provide rigorous empirical evidence for the potential social cost of migration —diminished trust among residents as a result of high out-migration —although migration has been commonly associated with mostly positive economic consequences in the relevant literature.

To establish causality, I exploit the panel nature of the data by using a first-difference specification and employ the instrumental variable strategy based on the classic economic model of migration with push and pull factors. While migration flows in an area might be correlated with the level of trust in that area, the destinations of migrants or more

[21] One might wonder to what extent respondents always provide the same answer to these related questions in the same section of the survey. As expected, these measures of social capital are positively correlated; however, the correlation coefficients between these measures fall in the range of 0.40-0.59, which is characterized as "moderate" (Evans, 1996).

specifically, attractions of the potential destinations that pull migrants out of the area are arguably exogenous to the changes in trust in the origin area. Based on this insight, I use revenues from the foreign markets and extreme weather conditions as push and pull factors to instrument for actual migration flows in the IV estimation. The IV estimates confirm the findings from the first-difference specification and suggest a significant and negative impact of migration outflows on trust among residents.

I then explore potential mechanisms by explicitly exploring the changes in social relations or interactions with respect to the rate of out-migration in communities of origin. If migration affects trust shared by the remaining population by lowering investment incentives in social capital, I would expect to find negative impacts of migration on social relations and interactions. I do find support for this channel in the data.

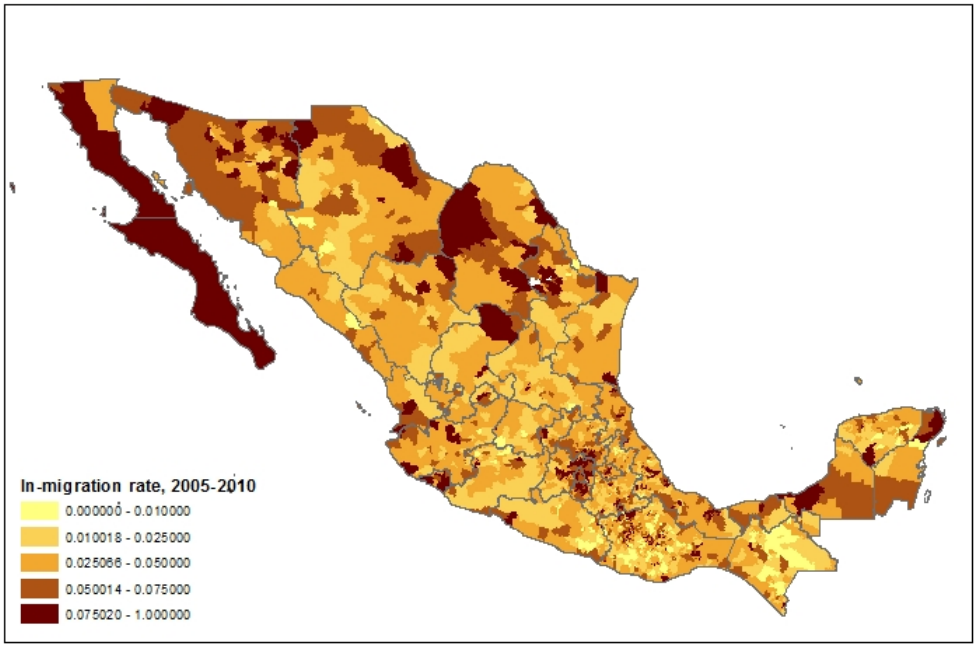
The exercise on the heterogeneity across urban and rural areas provides more detailed understandings on the mechanism through which migration affects trust in communities of origin. Another potential channel apart from investment incentives in social capital is through the out-migration of friends and relatives whom one used to trust when the migration rate is high in one's community. The estimated relationship is then expected to be higher in rural areas with dense social networks. However, I do not find support for this alternative hypothesis. Instead, I find that the adverse impact of out-migration on trust appears to be mitigated in rural areas. I believe that the likelihood of opportunism (of not returning the trust of someone when given it) in anticipation of a short-term relationship is lower in rural areas when the pre-existing social networks are dense and remain even in the event of some members' migration. Further, the information of cheating or abusing trust spreads more quickly within dense social networks.

This paper focuses on establishing the causal link between internal migration and how much individuals trust each other. Given the findings, I believe it would be imperative to understand the multifaceted consequences of migration flows at origin areas and therefore in promoting sustainable development supported by strong social capital in developing countries.

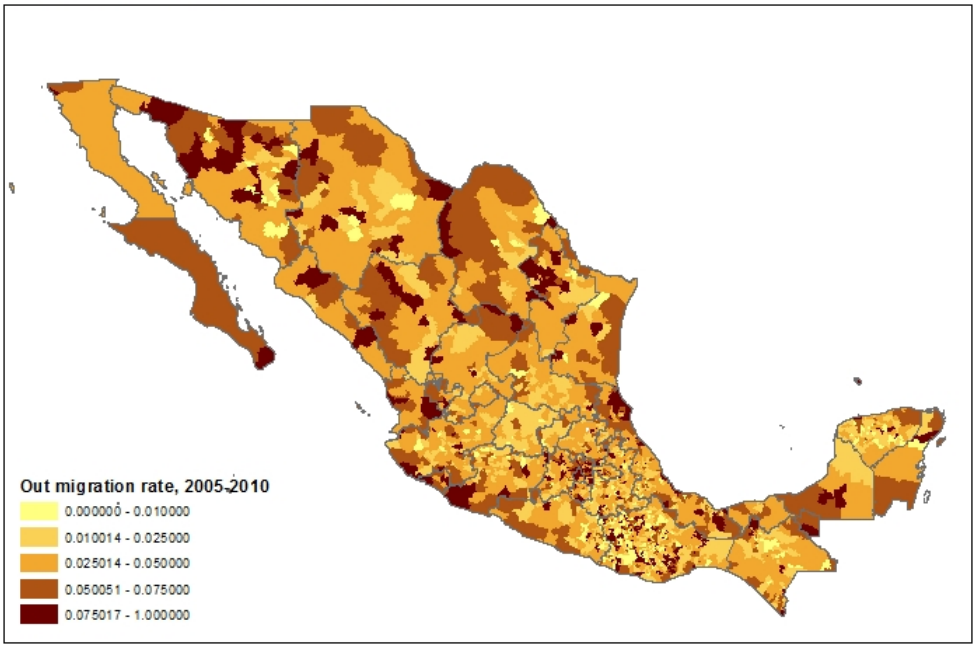
Figures and Tables

Figure 3.1: Migration rate at the municipality level, 2005-2010

Panel A: In-migration rate between 2005 and 2010

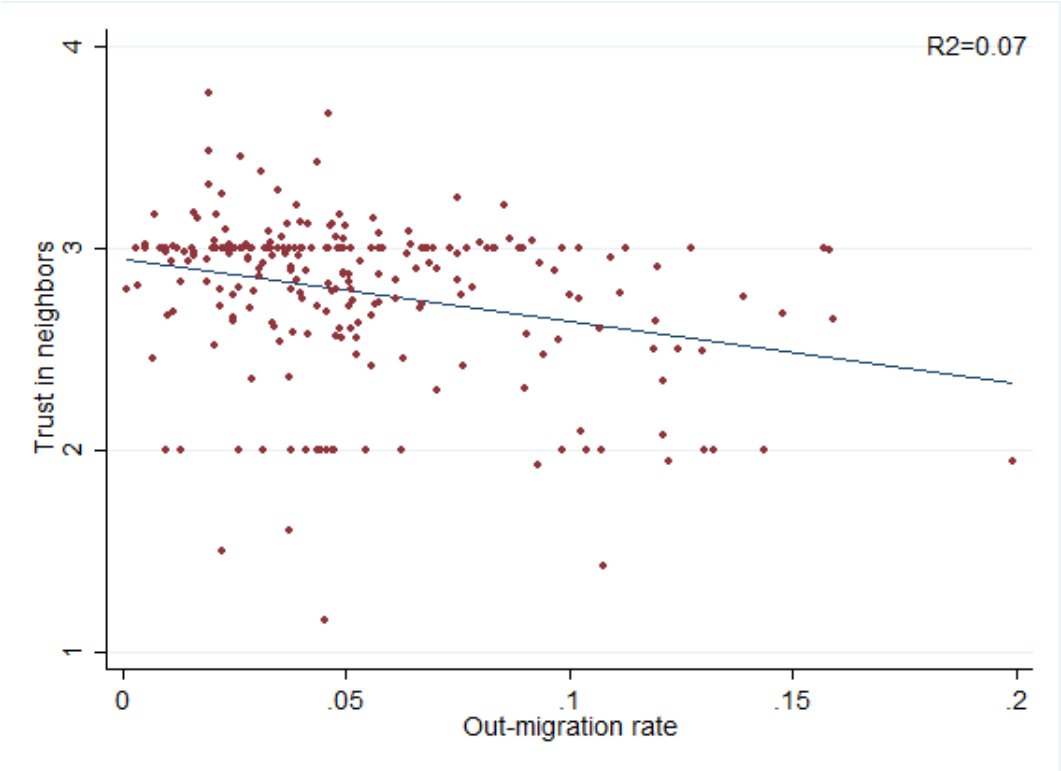


Panel B: Out-migration rate between 2005 and 2010



Note: Panel A and B visually show in- and out-migration rate over 2005-2010, respectively. The rates represent the number of migrants arriving in or leaving a municipality between 2005 and 2010 as a share of existing population in that municipality and are constructed based on the Mexican Population and Housing Census 2010.

Figure 3.2: Correlation between trust and out-migration rate at the municipality level



Note: the graph plots the relationship between trust and out-migration rate at the municipality level in 2009. Data on trust in neighbors comes from the MXFLS. Out-migration rate over 2005-2010 is constructed based on the Mexican Population and Housing Census 2010.

Table 3.1: Summary statistics

	Mean	SD
Household level variables:		
2005		
Age of household head	49.5	15.8
Education of household head	3.6	2.03
Children below age 10	0.5	0.5
Household income (unit: $ 10,000 US)	0.42	0.50
Household size	4.676	2.315
Homeownership	0.831	0.375
Trust	2.9	0.6
Willingness to help	2.8	0.6
Value sharing	2.6	0.7
2009		
Age of household head	52.6	15.5
Education of household head	3.6	2.1
Children below age 10	0.5	0.5
Household income	0.38	0.52
Household size	5.242	2.696
Homeownership	0.827	0.378
Trust	2.9	0.7
Willingness to help	2.8	0.8
Value sharing	2.7	0.8
Municipality level variables (2005-2010):		
Key covariates:		
Out-migration rate	0.038	0.029
In-migration rate	0.045	0.043
Instruments (predicted rates):		
Out-migration, all	0.017	0.020
In-migration, all	0.035	0.044
Out-migration, out of state	0.005	0.011
In-migration, out of state	0.015	0.028

NOTE: *Trust* is the answer to the following statement: "People from this locality/community are trustworthy." *Unity* is the answer to the following statement: "the neighborhood is united and really close". *Willingess to Help* is the answer to the following statement: "people around here are willing to help their neighbors". *Value Sharing* is the answer to the following statement: "people from this neighborhood share the same values"

Table 3.2: Determinants of in- and out migration at the municipality level, 2005-2010

	Dependent Variable	
Determinants	In-migration rate	Out-migration rate
Change in the revenue	0.0577**	0.0316**
from the maquiladora industry	(0.0239)	(0.0154)
Rural areas	-0.0109***	-0.00763***
	(0.00202)	(0.00132)
Days over 32 degrees	0.000006	0.00008*
	(0.000006)	(0.000004)
Days below 10 degrees	0.00003	0.00009**
	(0.000006)	(0.000004)
Observations	2,142	2,110

NOTE: In- and out-migration rates are migration inflows and outflows over the period 2005 and 2010 divided by the population in 2005, respectively and are based on the Mexican Population and Housing Census 2010. The data on the change in the revenue from the Maquila industry come from the Economic Census 2004 and 2009. Days over 32 degrees and below 10 degrees are deviation from the historical mean number of those days. Standard errors are in parentheses. *** p<0.01, ** p<0.05, * p<0.1

Table 3.3: The effect of out-migration on trust: Mexico, 2005-2010

	(1)	(2)	(3)	(4)
	FD	FD-IV	First Stage	Reduced-form
Out-migration rate	-1.117**	-1.882**		
	(0.487)	(0.914)		
Predicted out-migration rate			1.169***	-2.200**
			(0.199)	(0.912)
Exogenous controls	Yes	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes
Number of municipalities	152	152	152	152
First-stage F-statistics			34.43	
Observations	6,158	6,158	6,158	6,158
R-squared	0.011	0.010	0.486	0.011

NOTE: Each regression includes state fixed effects. Regression in (1) is run in first-difference specification shown in equation (1) while regression (2) is in the corresponding IV specification. The dependent variable *Trust* is the answer to the following statement: "People from this locality/community are trustworthy." The regression in (4) is in the reduced-form. (3) reports the first stage of the IV estimation shown in (2). Standard errors are in parentheses and clustered at the municipality level. *** p<0.01, ** p<0.05, * p<0.1

Table 3.4: Robustness checks: the effect of out-migration on trust

	(1) FD-IV	(2) FD-IV	(3) FD	(4) FD	(5) FD-IV	(6) FD-IV	(7) FD	(8) FD-IV
Out-migration rate	-1.329*	-1.205			-3.918**	-5.350*	-0.965*	-2.277***
	(0.759)	(0.736)			(1.999)	(3.238)	(0.563)	(0.876)
Out-migration rate, instrument			-1.913*	-1.906*				
			(1.018)	(1.094)				
Exogenous controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
First-stage F-statistics	53.60	47.80			12.52	11.18		67.83
Number of municipalities	152	152	152	152	129	82		
Observations	6,158	6,158	6,158	6,158	5,646	3,270	6,158	5,974
R-squared	0.011	0.011	0.010	0.010	0.012	0.009	0.010	0.011

NOTE: Each regression includes state fixed effects. *Trust* is the answer to the following statement: "People from this locality/community are trustworthy." The instrument used in column 1 excludes migrants who are expected to relocate out of their own states but within 100 km from the state border. Similarly, the instrument used in column 2 excludes migrants who are expected to relocate out of their own states but within 200 km from the state border. Column 3 and 4 report reduced form regressions that correspond to specification in column 1 and 2, respectively. Column 5 includes the following municipality-level controls: the average completed grade of the population, criminal activities, public expenditure of the municipal government. Column 6 further includes proxies for urbanisation: the number of water supply sources and of electric power services. The regression in column 7 includes international migrants in out-migration rates. Column 8 reports the IV estimate of the effect of out-migration including international migrants using the historical migration rate instrument. Standard errors are in parentheses and clustered at the municipality level. *** p<0.01, ** p<0.05, * p<0.1

Table 3.5: Mechanism: the effect of out-migration on social relations and interactions

	(1) FD-IV	(2) FD-IV	(3) FD-IV	(4) FD-IV	(5) FD-IV
Out-migration rate	-1.799	-2.499**	-1.285	-1.934**	-1.068
	(1.186)	(1.170)	(0.893)	(0.938)	(1.091)
Exogenous controls	Yes	Yes	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes	Yes
First-stage F-statistics	34.89	34.79	35.26	34.89	35.20
Number of municipalities	154	154	154	154	154
Observations	6,285	6,305	6,269	6,304	6,320
R-squared	0.009	0.016	0.009	0.006	0.007

NOTE: Each regression includes state fixed effects. The dependent variable in regression (1): "How often do people from your community do favors to each other?", (2): "When a neighbor is away, how often do you or your neighbors watch his/her house?", (3): "How often do you and other people from your community ask for advice to each other about things like raising your children or getting a new job?", (4): "How often do people from your community have parties in which you invite other people from the community?", and (5): "How often do you and other people from your community gather in each other's houses or on the street?". Respondents answer the questions by choosing from "Never", "Rarely", "Frequently" or "Always". Higher values correspond to higher frequency. Standard errors are in parentheses and clustered at the municipality level. *** p<0.01, ** p<0.05, * p<0.1

Table 3.6: Heterogeneity: the effect of migration on trust

	(1)	(2)	(3)	(4)	(5)	(6)
	All sample	Urban areas		Rural areas		
	FD	FD	FD-IV	FD	FD-IV	FD-IV
Out-migration rate	-1.117**	-1.496**	-2.298**	0.620	-2.117	-1.179
	(0.487)	(0.648)	(1.118)	(1.300)	(4.711)	(3.020)
Exogenous controls	Yes	Yes	Yes	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
First-stage F-statistics			52.99		4.17	10.52
Number of municipalities	152	101	101	73	73	69
Observations	6,158	3,265	3,265	2,893	2,893	2,761
R-squared	0.011	0.014	0.013	0.026	0.023	0.028

NOTE: Each regression includes state fixed effects. The dependent variable *Trust* is the answer to the following statement: "People from this locality/community are trustworthy." Column 3 and 5 use the predicted out-migration rate as an instrument. Column 6 uses the historical migration rate between 1995 and 2000 as an alternative instrument. Standard errors are in parentheses and clustered at the municipality level. *** p<0.01, ** p<0.05, * p<0.1

Table 3.7: The effect of out-migration on other measures of social capital

Dependent Variable	(1) Willingness to Help	(2) Value Sharing	(3) Index
Panel 1 First-difference IV			
Out-migration rate	-2.502***	-2.793***	-4.929**
	(0.872)	(1.062)	(1.965)
Panel 2 Reduced-form			
Predicted out-migration rate	-2.948***	-3.277***	-5.753***
	(0.924)	(1.139)	(1.964)
Exogenous controls	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes
First-stage F-statistics	34.76	34.50	33.41
Number of municipalities	154	153	151
Observations	6,204	5,837	5,681

NOTE: *Willingess to Help* is the answer to the following statement: "people around here are willing to help their neighbors". *Value Sharing* is the answer to the following statement: "people from this neighborhood share the same values". *Index* is created based on the four social capital measures, trust, unity, willingness to help and value sharing. Standard errors are in parentheses and clustered at the municipality level. *** p<0.01, ** p<0.05, * p<0.1

Appendix A

Appendix to Chapter 1

A.1 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 we constructed based on the answers, which 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 1.12 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.

A.2 Correlation between inherited trust and contemporaneous trust: alternative interpretations

In section 2.4.2.2 in the main text, we discussed the possibility of convergence in trust attitudes of US immigrants as an alternative interpretation of time variation in inherited trust we observe. Table 1.3 provides evidence against this interpretation by showing that

there are statistically significant differences in inherited trust across countries of origin for immigrants in cohort 1950, which should have not been the case had there been a convergence in attitudes. Here we provide further evidence against this interpretation by decomposing each cohort by generations of immigrants. If there had been strong convergence, it should have been most pronounced among the fourth-generation immigrants given the time they spent in the host country.

We run the same regression that we estimate for Table 1.5 but on decomposed samples. Table A.4 report the results. The dependent variables in (1) and (2) are the level of trust inherited by second-, third-generation immigrants in cohort 2010 and fourth-generation immigrants in cohort 2010, respectively. The dependent variables in (3) and (4) are the level of trust inherited by second-, third-generation immigrants in cohort 1950 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 provided by the WVS and the ESS. In Column 2, we find that the contemporaneous trust in the country of origin is a statistically significant predictor of the trust inherited in 2010 by fourth-generation immigrants.

Column 3 and 4 decomposes cohort 1950 into second-, third-generation immigrants and fourth-generation immigrants, respectively. We find a strong correlation between inherited trust and current trust in the country of origin for second- and third-generation immigrants, while the correlation becomes weak in fourth-generation immigrants. We report the results from the same decomposition exercise for the specification with a 50-year lag and with different time periods, 1970-2010. The results are qualitatively consistent, providing evidence for the evolution of trust attitudes, rather than strong convergence (Table A.13, A.18).

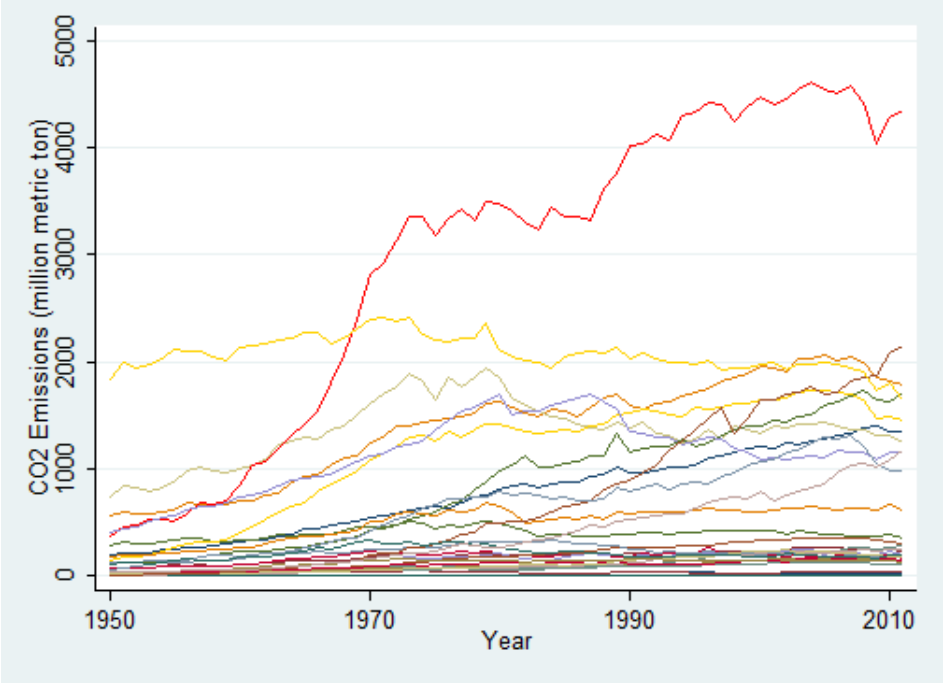


Figure A.1: CO_2 Emissions in OECD countries: 1950-2010

Sources: Carbon Dioxide Information Analysis Center (CDIAC)

Table A.1: Observations for Inherited Trust 1950 and 2010: GSS 1978-2014

County of origin	Inherited trust in 1950	Inherited trust in 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 A.2: 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 A.3: European Countries Only: Correlation between inherited trust of US descendants and trust in the country of origin

	Dependent variables	
	Inherited trust in 2010 (1)	Inherited trust in 1950 (2)
Trust in source country	0.167***	0.082
	(0.058)	(0.066)
Age	0.004***	0.003***
	(0.001)	(0.000)
Men	0.058*	0.009
	(0.028)	(0.007)
Eduation	0.027***	0.037***
	(0.002)	(0.002)
Income	0.002	0.008***
	(0.004)	(0.001)
Unemployed	-0.021	0.009
	(0.030)	(0.027)
Employed	0.037	0.034**
	(0.037)	(0.012)
Catholic	0.001	0.047
	(0.035)	(0.028)
Protestant	0.036*	0.030***
	(0.019)	(0.009)
Constant	-0.271***	-0.353***
	(0.048)	(0.036)
Observations	2,898	10,577
R-squared	0.039	0.056

Notes: The sample is restricted to European countries in these regressions. The dependent variables in (1) and (2) are the level of trust inherited in 2010 and in 1950, respectively. Trust in source country is the average level of trust in the country of origin of the immigrants in 2010.

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

Table A.4: Correlation between inherited trust of US descendants and trust in the country of origin: Sample decomposition by generation

	Dependent variables			
	Inherited trust in 2010 2nd 3rd generation (1)	Inherited trust in 2010 4th generation (2)	Inherited trust in 1950 2nd 3rd generation (3)	Inherited trust in 1950 4th generation (4)
Trust in source country	0.379*** (0.109)	0.515** (0.209)	0.380*** (0.117)	0.424 (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 the level of trust inherited by second-, third-generation immigrants in cohort 2010 and fourth-generation immigrants in cohort 2010, respectively. The dependent variables in (3) and (4) are the level of trust inherited by second-, third-generation immigrants in cohort 1950 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 A.5: Observations for Inherited Trust in 1920 and 1980
With 25 Years: GSS 1978-2014

	Inherited trust in 1920	Inherited trust in 1980
County of origin	with a 25-year lag	with a 25-year lag
Africa	716	2,237
Austria	14	131
Canada	67	310
Czechoslovakia	28	350
Denmark	38	187
Finland	12	116
France	153	468
Germany	1,339	4,100
Ireland	1,063	2,954
Italy	53	1,637
Mexico	27	633
Netherlands	137	341
Norway	89	484
Poland	45	806
Russian Federation	13	364
Spain	41	193
Sweden	70	454
Switzerland	42	99
United Kingdom	2,046	3,265

Table A.6: Descriptive Statistics: GSS 1978-2014

Variables	Cohort 1920 with a 25-year lag		Cohort 1980 with a 25-year lag	
	Mean	SD	Mean	SD
Age	64.96	12.38	41.65	15.01
Men	0.42	0.49	0.46	0.50
Education	12.45	3.23	13.71	2.67
Income	10.03	2.66	10.76	2.33
Employed	0.38	0.48	0.71	0.45
Unemployed	0.02	0.15	0.06	0.23
Protestant	0.79	0.41	0.52	0.50
Catholic	0.15	0.36	0.29	0.45

Table A.7: Inherited Trust in 1920 and 1980: with a 25-year lag

	Dependent variables			
	Inherited trust in 1920		Inherited trust in 1980	
	Coefficient	SD	Coefficient	SD
Country of Origin	Reference: Swedish ancestors - 1920			
Sweden			0.087	(0.047)
Africa	-0.200	(0.049)	-0.160	(0.045)
Austria	-0.260	(0.049)	0.120	(0.049)
Canada	0.050	(0.050)	0.054	(0.051)
Czechoslovakia	-0.021	(0.051)	0.053	(0.051)
Denmark	-0.160	(0.052)	0.180	(0.047)
Finland	-0.160	(0.040)	0.080	(0.047)
France	0.073	(0.051)	0.040	(0.048)
Germany	0.032	(0.051)	0.064	(0.047)
Ireland	0.011	(0.051)	0.061	(0.048)
Italy	0.036	(0.047)	-0.014	(0.052)
Mexico	0.110	(0.060)	-0.014	(0.051)
Netherlands	-0.046	(0.049)	0.032	(0.046)
Norway	0.200	(0.044)	0.140	(0.046)
Poland	0.016	(0.047)	0.016	(0.051)
Russia	-0.110	(0.046)	0.034	(0.046)
Spain	-0.005	(0.054)	0.049	(0.050)
Switzerland	0.120	(0.050)	0.074	(0.046)
United Kingdom	0.057	(0.050)	0.077	(0.046)

Notes: The dependent variable is the level of trust inherited by US immigrants from the periods 1920 and 1980 and measured 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?" We construct a binary trust variable that 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." Additional controls included in the model are: age, age square, 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 A.8: Correlation between inherited trust of US descendants and trust in the country of origin: with a 25-year lag, 1920-1980

	Dependent variables	
	Inherited trust in 1980	Inherited trust in 1920
Trust in source country	0.423**	0.459**
	(0.152)	(0.201)
Age	0.004***	0.001
	(0.000)	(0.001)
Men	0.022**	0.032**
	(0.008)	(0.014)
Education	0.035***	0.035***
	(0.003)	(0.003)
Income	0.006***	0.009***
	(0.002)	(0.003)
Unemployed	0.001	-0.041
	(0.021)	(0.039)
Employed	0.033**	0.010
	(0.013)	(0.025)
Catholic	0.040	0.164***
	(0.028)	(0.034)
Protestant	0.012	0.076**
	(0.016)	(0.031)
Constant	-0.508***	-0.417***
	(0.059)	(0.086)
Observations	11,948	3,786
R-squared	0.078	0.094

Notes: The dependent variables in (1) and (2) are the level of trust inherited by all immigrants (2nd, 3rd and 4th) in 1980 and in 1920, 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.

Table A.9: Observations for Inherited Trust in 1950 and 2010 with Lag 50 Years: GSS 1978-2014

County of origin	Inherited trust in 1950 with a lag of 50 years	Inherited trust in 2010 with a lag of 50 years
Africa	981	1,980
Austria	21	128
Belgium	13	44
Canada	91	291
Czechoslovakia	51	335
Denmark	56	172
Finland	19	110
France	210	412
Germany	1,793	3,688
Greece	10	101
Hungary	11	139
India	12	25
Ireland	1,437	2,607
Italy	96	1,653
Mexico	51	671
Netherlands	174	311
Norway	151	430
Poland	77	786
Russia	24	363
Spain	51	189
Sweden	100	431
Switzerland	54	54
United Kingdom	2,572	2,756

Table A.10: Descriptive Statistics: GSS 1978-2014

Variables	Cohort 1950 with a 50-year lag		Cohort 2010 with a 50-year lag	
	Mean	SD	Mean	SD
Age	61.55	13.7	40.39	14.93
Men	0.43	0.49	0.46	0.50
Education	12.74	3.19	13.73	2.65
Income	10.25	2.549	10.74	2.374
Employed	0.45	0.50	0.72	0.45
Unemployed	0.03	0.17	0.06	0.24
Protestant	0.76	0.43	0.50	0.50
Catholic	0.16	0.37	0.30	0.46

Table A.11: Inherited Trust in 1950 and 2010: with a 50-year lag

	Dependent variables			
	Inherited trust in 1950		Inherited trust in 2010	
	Coefficient	SD	Coefficient	SD
Country of Origin	Reference: Swedish ancestors - 1950			
Sweden			0.059	(0.015)
Africa	-0.200	(0.02)	-0.190	(0.015)
Austria	-0.047	(0.017)	0.083	(0.016)
Belgium	0.200	(0.022)	0.130	(0.016)
Canada	0.022	(0.020)	0.039	(0.002)
Czechoslovakia	-0.068	(0.017)	0.046	(0.018)
Denmark	-0.094	(0.018)	0.160	(0.014)
Finland	-0.090	(0.019)	0.053	(0.017)
France	0.089	(0.018)	-0.011	(0.015)
Germany	0.039	(0.019)	0.028	(0.015)
Greece	0.300	(0.024)	-0.110	(0.013)
Hungary	0.140	(0.018)	0.061	(0.015)
India	-0.110	(0.021)	-0.250	(0.017)
Ireland	0.022	(0.019)	0.025	(0.016)
Italy	-0.006	(0.018)	-0.041	(0.019)
Mexico	0.130	(0.026)	-0.049	(0.019)
Netherlands	-0.055	(0.021)	0.010	(0.015)
Norway	0.170	(0.018)	0.098	(0.014)
Poland	0.019	(0.02)	-0.009	(0.018)
Russia	-0.077	(0.015)	0.012	(0.013)
Spain	0.032	(0.022)	-0.002	(0.019)
Switzerland	0.120	(0.018)	0.030	(0.014)
United Kingdom	0.052	(0.019)	0.042	(0.014)

Notes: The dependent variable is the level of trust inherited by US immigrants from the periods 1950 and 2010 and measured 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?" We construct a binary trust variable that 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." Additional controls included in the model are: age, age square, 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 A.12: Correlation between inherited trust of US descendants and trust in the country of origin: with a 50-year lag

	Dependent variables	
	Inherited trust in 2010	Inherited trust in 1950
Trust in source country	0.417***	0.433**
	(0.144)	(0.203)
Age	0.004***	0.001
	(0.000)	(0.000)
Men	0.027***	0.021*
	(0.008)	(0.012)
Education	0.034***	0.035***
	(0.003)	(0.003)
Income	0.006***	0.009***
	(0.002)	(0.003)
Unemployed	-0.011	-0.019
	(0.016)	(0.023)
Employed	0.025*	0.020
	(0.014)	(0.019)
Catholic	0.033	0.124***
	(0.028)	(0.030)
Protestant	0.010	0.035
	(0.017)	(0.028)
Constant	-0.493***	-0.355***
	(0.059)	(0.081)
Observations	11,160	5,102
R-squared	0.075	0.090

Notes: The dependent variables in (1) and (2) are the level of trust inherited by all immigrants (2nd, 3rd and 4th) in 2010 and in 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.

Table A.13: Correlation between inherited trust of US descendants and trust in the country of origin: Sample decomposition by generation with a 50-year lag

	Dependent variables			
	Inherited trust in 2010 2nd 3rd generation	Inherited trust in 2010 4th generation	Inherited trust in 1950 2nd 3rd generation	Inherited trust in 1950 4th generation
	(1)	(2)	(3)	(4)
Trust in source country	0.411***	0.440*	0.204	0.413
	(0.058)	(0.252)	(0.207)	(0.320)
Observations	4,383	6,777	566	4,536
R-squared	0.058	0.074	0.056	0.094

Notes: The dependent variables in (1) and (2) are the level of trust inherited by second-, third-generation immigrants in cohort 2010 and fourth-generation immigrants in cohort 2010, respectively. The dependent variables in (3) and (4) are the level of trust inherited by second-, third-generation immigrants in cohort 1950 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 A.14: Observations for Inherited Trust in 1970 and 2010
With Lag 50 Years: GSS 1978-2014

County of origin	Inherited trust in 1970 with a 50-year lag	Inherited trust in 2010 with a 50-year lag
Africa	2,315	647
Austria	71	75
Belgium	34	23
Canada	222	166
Czechoslovakia	200	198
Denmark	173	56
Finland	77	51
France	468	157
Germany	4,059	1,421
Greece	36	80
Hungary	58	92
India	26	11
Ireland	3,002	1,042
Italy	665	1,133
Japan	15	58
Mexico	208	523
Netherlands	345	140
Norway	392	184
Poland	410	466
Portugal	38	53
Russia	173	229
Spain	143	99
Sweden	351	179
Switzerland	104	37
United Kingdom	4,413	914
Yugoslavia	48	70

Table A.15: Descriptive Statistics: GSS 1978-2014

Variables	Cohort 1970 with a 50-year lag		Cohort 2010 with a 50-year lag	
	Mean	SD	Mean	SD
Age	51.41	16.93	36.98	14.27
Men	0.44	0.50	0.46	0.50
Education	13.22	2.95	13.89	2.58
Income	10.5	2.46	10.81	2.35
Employed	0.59	0.49	0.72	0.45
Unemployed	0.04	0.21	0.06	0.24
Protestant	0.66	0.47	0.39	0.49
Catholic	0.22	0.41	0.35	0.48

Table A.16: Inherited Trust in 1970 and 2010: with a 50-year lag

	Dependent variables			
	Inherited trust in 1970		Inherited trust in 2010	
	Coefficient	SD	Coefficient	SD
Country of Origin	Reference: Swedish ancestors - 1970			
Sweden			0.003	(0.02)
Africa	-0.250	(0.022)	-0.190	(0.027)
Austria	0.059	(0.019)	-0.022	(0.019)
Belgium	0.200	(0.020)	-0.015	(0.020)
Canada	-0.016	(0.022)	0.023	(0.021)
Czechoslovakia	-0.023	(0.017)	0.003	(0.018)
Denmark	0.015	(0.018)	0.200	(0.017)
Finland	-0.006	(0.016)	0.010	(0.015)
France	0.003	(0.020)	-0.095	(0.021)
Germany	-0.006	(0.019)	-0.031	(0.022)
Greece	0.110	(0.018)	-0.230	(0.019)
Hungary	0.050	(0.017)	0.003	(0.018)
India	-0.210	(0.026)	-0.330	(0.028)
Ireland	-0.016	(0.020)	-0.023	(0.023)
Italy	-0.036	(0.019)	-0.100	(0.022)
Japan	-0.047	(0.017)	-0.022	(0.018)
Mexico	0.055	(0.022)	-0.130	(0.025)
Netherlands	-0.083	(0.020)	0.004	(0.021)
Norway	0.085	(0.019)	0.021	(0.020)
Poland	-0.006	(0.020)	-0.077	(0.021)
Portugal	-0.004	(0.020)	-0.099	(0.020)
Russian Federation	-0.046	(0.016)	-0.031	(0.017)
Spain	-0.074	(0.023)	0.018	(0.025)
Switzerland	0.005	(0.020)	0.053	(0.019)
United Kingdom	-0.001	(0.019)	0.015	(0.022)
Yugoslavia	-0.003	(0.016)	-0.018	(0.021)

Notes: The dependent variable is the level of trust inherited by US immigrants from the periods 1970 and 2010 and measured 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?" We construct a binary trust variable that 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." 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 A.17: Correlation between inherited trust of US descendants and trust in the country of origin: with a 50-year lag, 1970-2010

	Dependent variables	
	Inherited trust in 2010	Inherited trust in 1970
Trust in source country	0.379***	0.425**
	(0.100)	(0.191)
Age	0.004***	0.003***
	(0.001)	(0.000)
Men	0.048**	0.016**
	(0.019)	(0.007)
Education	0.033***	0.035***
	(0.002)	(0.002)
Income	0.002	0.010***
	(0.003)	(0.001)
Unemployed	-0.045**	0.019
	(0.018)	(0.023)
Employed	0.019	0.032**
	(0.028)	(0.015)
Catholic	0.016	0.073***
	(0.032)	(0.024)
Protestant	0.017	0.011
	(0.016)	(0.016)
Observations	4,836	11,499
R-squared	0.069	0.083

Notes: The dependent variables in (1) and (2) are the level of trust inherited by all immigrants (2nd, 3rd and 4th) in 2010 and in 1970, 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.

Table A.18: Correlation between inherited trust of US descendants and trust in the country of origin: Sample decomposition by generation with a 50-year lag, 1970-2010

	Dependent variables			
	Inherited trust in 2010 2nd 3rd generation	Inherited trust in 2010 4th generation	Inherited trust in 1970 2nd 3rd generation	Inherited trust in 1970 4th generation
	(1)	(2)	(3)	(4)
Trust in source country	0.297***	0.456***	0.312***	0.419*
	(0.056)	(0.117)	(0.104)	(0.209)
Observations	3,042	1,794	1,980	9,519
R-squared	0.054	0.076	0.059	0.087

Notes: The dependent variables in (1) and (2) are the level of trust inherited by second-, third-generation immigrants in cohort 2010 and fourth-generation immigrants in cohort 2010, respectively. The dependent variables in (3) and (4) are the level of trust inherited by second-, third-generation immigrants in cohort 1970 and fourth-generation immigrants in cohort 1970, 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.

A.3 Further Data Description

The choice of our sample countries is guided by the set of countries of origin in the General Social Survey (GSS) that the respondents could choose from and they include some countries that do not perfectly overlap with current geographic boundaries (as of 2010 which is our data end point) such as Czechoslovakia, Yugoslavia and the Soviet Union. The survey also does not allow respondents to choose specific African countries from which their ancestors came since the whole continent (Africa) is provided as a single category. Thus in this section we explain how relevant countries are combined in order to make them consistent with our sample.

CO_2 Emissions We use fossil fuel CO_2 emissions data from the Carbon Dioxide Information Analysis Center (CDIAC). The data is given in thousand metric tons of carbon, which convert to thousand metric tons of carbon dioxide by multiplying the figures by 3.667 as advised. The 1950 to present CO_2 emission data are derived primarily from energy statistics published by the United Nations (2016).

We make modifications for the following five cases to make the emissions variable consistent with our unit of observations: Germany, Czechoslovakia, Yugoslavia, the Soviet Union and Africa. First, Germany has two observations for each year between 1945 and 1990 since the country was divided into Federal Republic of Germany and Former German Democratic Republic. We sum up emissions from these two parts of the country to one observation. Second, Czechoslovakia has one observation up to 1991 and from 1992 onwards emissions are separately reported for Czech Republic and Slovakia, which again corresponds to the political dissolution Czechoslovakia into two mentioned independent countries. However, since Czechoslovakia is the category used in the GSS we combine the emissions from Czech Republic and Slovakia and make them one observation. Yugoslavia is similar to the case of Czechoslovakia. It has one observation per year up to 1991 and splits to five observations (Bosnia & Herzegovina, Croatia, Macedonia, Slovenia and Montenegro & Serbia) from 1992. Again, we combine the five observations per year to one observation per year to make it comparable to the GSS division of the world. A similar treatment is applied to the former Soviet Union, which dissolved into 15 independent states in 1991 (namely, Armenia, Azerbaijan, Belarus, Estonia, Goergia, Kazakhstan, Kyrgyzstan, Latvia, Moldova, Lithuania, Russian Federation, Tajikistan, Turkmenistan, Ukraine and Uzbekistan). We sum emissions from the 14 states (Moldova is missing in the dataset) to convert them into one observation.

The number of African countries in the dataset slowly increases over time, from 25 in 1950 (the starting point of our analysis) and 51 in 2010 (the end point of our analysis) out of 54 countries that make up Africa. We believe this omission is due to the small, almost negligible amount of emissions from African countries in earlier years. For

instance, in 1950 the reported CO_2 in South Africa, the largest emitter in the continent, constitutes only about 1 percent of the global emissions and Egypt, the second largest emitter, accounts for less than 0.2 percent. Thus we proceed as we did with other countries and sum up emissions from all African countries included in the dataset for each year.

GDP per capita and Population Data on GDP per capita and population come from the Maddison Project that provides information on economic growth across countries between AD 1 and 2010. Fortunately, the database includes information on Czechoslovakia, Yugoslavia, the Soviet Union and Africa as a whole, so we did not have to process these variables to make them compatible with our sample countries.

Trade Openness We use version 7.3 of the Penn World Table for data on trade openness, which is defined as the sum of import and export divided by the GDP of the country. One peculiarity of this dataset is that for countries that constituted former Czechoslovakia, former Yugoslavia and the former Soviet Union the data begin in 1990. Thus we, reluctantly, replace the missing values for year 1950 with the values of 1990 for the relevant countries. However, as we discuss in footnote 19, excluding these countries does not affect the results of our analysis. For Africa, similarly as for GDP per capita and population data, we calculate the average openness to trade across all African countries for each year in our sample.

Quality of Political Institutions We use the Polity IV dataset by the Center for Systemic Peace for our variables related to the quality of formal institutions. What we do here is identical to what we do for the data on CO_2 emissions for the same set of relevant countries, except that now we calculate the mean instead of the sum.

Sectoral composition of economy We use International Historical Statistics by B.R. Mitchell (2013) for the measure of sectoral composition of economies worldwide. The database includes information on Czechoslovakia, Yugoslavia, and the Soviet Union. For Africa, we again calculate the average share of manufacturing industry for each year. Switzerland is missing in the database, so we complement the variable using Stohr et al. (2014). Dropping Switzerland does not affect our findings (detailed results available upon request from authors).

Educational Attainment For historical data on primary school enrolment, we rely on Lee and Lee (2016). The data begin in 1820 and continue to 2010 at a five-year interval. Former Yugoslavia countries and Slovak Republic are missing in the dataset. Thus we leave Yugoslavia as missing and allow Czech Republic to represent Czechoslovakia. For Africa, we again calculate the average rate of primary school enrolment in African

countries for each year.

Religion Data on the share of non-religious individuals and religious fractionalisation in a country come from Barro (2003). The dataset includes only three time periods, 1900, 1970 and 2000. Thus we use 1970 and 2000 values for 1950 and 2010, respectively, in our analysis. For 1970, Germany is split in two states, East and West Germany, so we calculate the mean of the two values for that year. For Africa, we again calculate the average share of non-religious individuals and religious fractionalisation in African countries for each time period.

Urbanization and Population Density We use data on urbanization and population density from the World Bank. Unfortunately, the data begin in 1960, so for year 1950 we instead use the values of 1960 for 1950. To form a variable for former Yugoslavian countries, we take the average of the five countries (Bosnia & Herzegovina, Croatia, Macedonia, Slovenia and Montenegro & Serbia) for each year.

Appendix B

Appendix to Chapter 2

B.1 Wealth as a competing factor?

In studying the relationship between trust and the stringency of climate change regulation, it is important to take into account the relative wealth of countries for two reasons; (1) the argument that rich, developed countries have emitted greater emissions over a longer period and therefore they are primarily responsible for climate change impacts, has led to more active mitigation efforts by richer economies (Adger, 2006); (2) trust tends to be positively correlated with wealth across countries (e.g. Algan and Cahuc, 2010). Then, it is possible that the positive correlation we observe between trust and the stringency of climate change legislation may simply reflect that richer nations contribute more actively to climate change mitigation.

However, column (2) in Table B.6 shows that the correlation between trust and the stringency of climate change policy measured by the target share of renewable energy in total consumption by 2020 remains strong even when I control for log GDP per capita as well as educational attainment (since it has been pointed out that countries with more educated citizenry are more likely to have stringent climate change polices).

As a simple placebo test, I use another measure of climate change regulation stringency that is comparable across EU countries: the national emission targets for 2020 set by the Effort Sharing Decision in the EU to reduce emissions from sectors not included in the EU ETS. Unlike the measure used above (which is based on National Renewable Energy Action Plan), these targets have been *assigned* on the basis of member states' relative wealth, therefore not voluntary. Given the positive relationship between trust and national wealth, this measure may also display a positive correlation with trust. However, the correlation should disappear once income is controlled for, because the involuntary nature of this policy rules out the argument put forward in this paper that trust could matter (independently or in addition to the country's wealth) via lower enforcement costs when countries are voluntarily choosing their own policies to contribute to joint objectives

(EU level binding targets in this case).

[Table B.6]

Column (3) and (4) confirm this intuition. The positive correlation between trust and the measure of involuntary climate policy in column (3) is absent when income and education are included in column (4). It is also interesting to note that log per capita GDP barely predicts the voluntary measure of climate policy in column (2) (increasing R-squared by only 0.02), whereas it accounts for a substantial share of variation in the involuntary measure of climate policy as anticipated (increasing R-squared by 0.49).

B.2 Domestic demand for environmental regulation

Previous studies that investigate the heterogeneity in the stringency of regulations (mostly economic regulations) across countries have emphasized the link that runs as follows: (1) trust and the public demand for regulations, (2) the public demand for and the actual stringency of regulations, and consequently (3) trust and the stringency of regulations. Does this link hold in the context of environmental legislation as well? Here I refer to environmental regulations at large, not exclusively climate change legislation due to data availability.

I obtain data on the demand for environmental regulations from the International Social Survey Programme (ISSP), which is the same survey used by (Aghion et al., 2010) to show the negative correlation between trust and demand for labor market regulation. I use the 2010 wave that includes questions both on trust and attitudes towards environmental regulation. The question that captures the degree of the demand for environmental regulations reads as follows: "Government should pass laws to make businesses protect the environment, even if it interferes with businesses's rights to make their own decisions".[1] I construct a binary variable from this question that takes 1 if respondents agreed with the given statement and 0 otherwise, and calculate the country average of this measure. For the stringency of environmental regulations, I use the Environmental Policy Stringency (EPS) Index in Figure B.2 that measures the stringency of regulatory instruments primarily related to climate and air pollution.

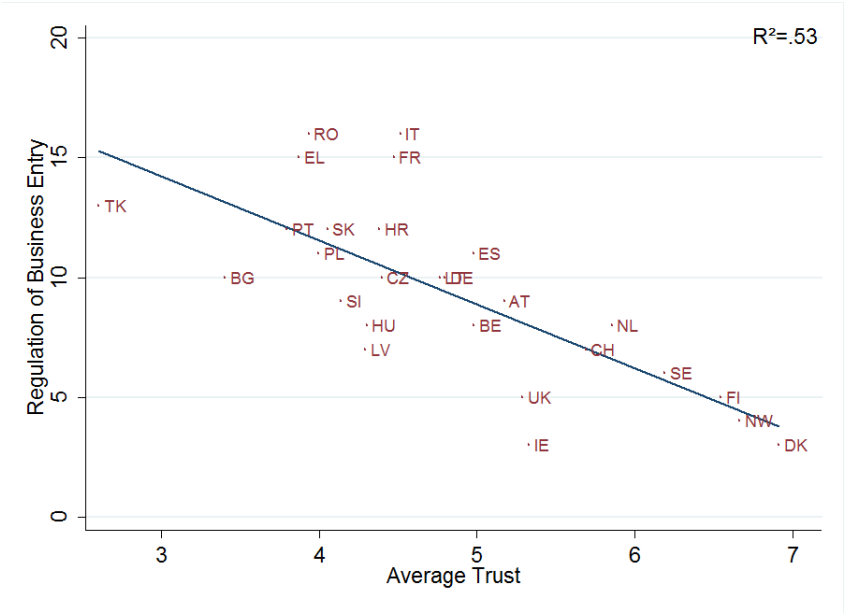
[Figure B.8, B.9]

[1]There is another related question that reads, "Government should pass laws to make ordinary people protect the environment, even if it interferes with people's rights to make their own decisions". I do not use this question for the public demand for environmental regulations because the measures for the stringency of environmental regulations mostly cover policy instruments that apply to industrial sectors (Botta and Koźluk, 2014), rather than ordinary individuals. However, results in this section are similar when I use this question as an alternative.

Figure B.8 reveals no discernible association between trust and the public demand for environmental regulations. Moreover, the correlation between the demand for and the actual stringency of environmental regulations is also weak as depicted in Figure B.9, which stands in contrast to the previous studies that explain the stringency of a variety of regulations as a function of the public demand.[2] Thus, the link (1) and (2) do not seem to hold when it comes to environmental regulations. However, we have seen the strong positive correlation between trust and this measure of environmental legislation stringency in Figure B.2, which is to say the link (3) holds despite the absence of the first two links. Taken together, I believe this casual inspection suggests that the influence of domestic demand is muted in this context and provides further support for the importance of supply side dynamics such as enforcement costs and the degree of public acceptability in the provision of environmental protection legislation across countries.

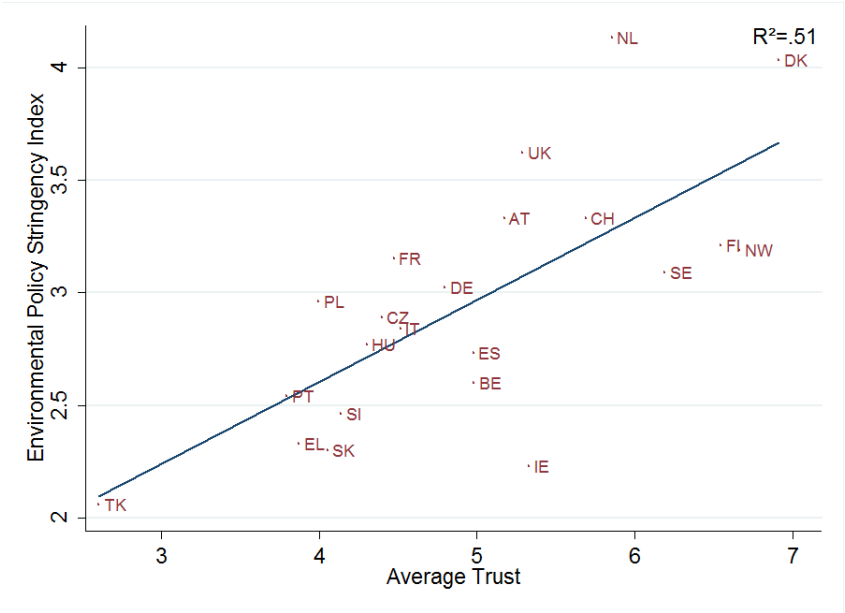
[2]One likely explanation is based on the environment being a secondary policy issue. There is a consensus that the public or the voters' preferences have large effects on "frontline" policies (mostly economic) such as government spending or wealth redistribution, there is widespread recognition that secondary policy issues, that concern only relatively small groups in society, such as environmental policy and gun control do not sensitively reflect preferences held by voters (List and Sturm, 2006).

Figure B.1: Correlation between Trust and Regulation of Business Entry



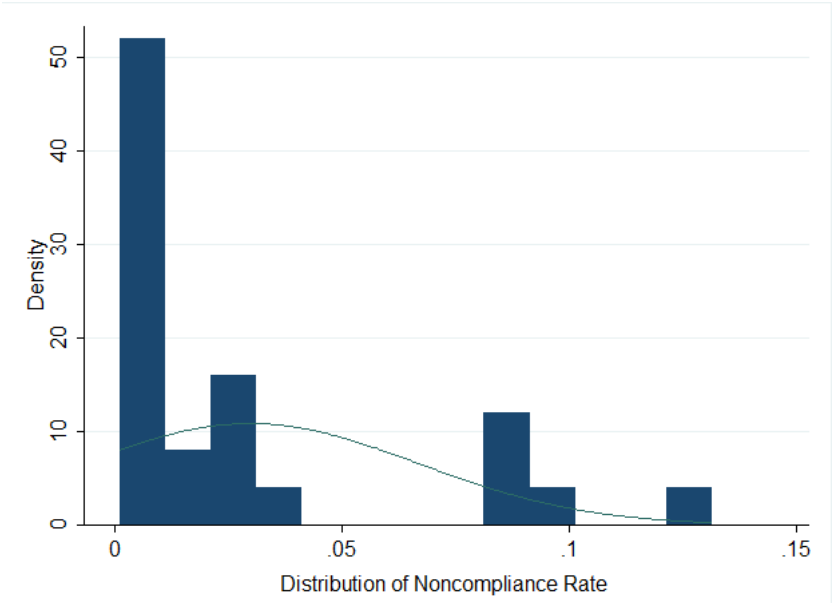
Note: the graph plots the relationship between the level of average trust and the stringency of market regulation measured by the number of steps that an entrepreneur has to complete to open a business across countries. This data on regulations on market entry is provided by Djankov et al. (2002) for the year 1999. The level of average trust measure is constructed based on the the European Social Survey (2000-2014).

Figure B.2: Correlation between Trust and the Environmental Policy Stringency (EPS) Index



Note: the graph plots the relationship between the level of average trust and the OECD Environmental Policy Stringency (EPS) Index. The level of average trust measure is constructed based on the European Social Survey (2002-2014).

Figure B.3: Distribution of Noncompliance Rates



Note: the plot shows the distribution of noncompliance rates across countries. The data on compliance in the ETS is provided by the European Union Transaction Log (EUTL) at the installations level and I collapse the data over time across countries to calculate average compliance rates.

Table B.1: Descriptive Statistics: Firm-level Variables

Country	Number of firms	Number of employees	Number of installations per firm	Total assets Thousand USD	Operating revenue Thousand USD
Austria	146	712	1.72	626,484	487,542
Belgium	248	945	1.54	3,320,201	814,570
Bulgaria	112	413	1.35	96,637	107,210
Czech Republic	278	850	1.58	279,192	223,508
Denmark	269	815	1.60	383,084	424,302
Estonia	37	184	1.54	144,959	60,214
Finland	183	802	3.68	514,466	412,311
France	669	5,281	1.85	3,173,589	1,624,696
Germany	1,194	2,730	1.92	1,719,551	1,614,392
Greece	104	584	1.46	508,478	409,479
Hungary	136	881	2.07	407,152	370,139
Ireland	113	4,386	1.39	5,439,998	4,342,960
Italy	747	1,037	1.68	971,609	707,199
Latvia	75	304	1.49	109,923	59,061
Lithuania	78	265	1.49	105,722	127,252
Netherlands	327	527	1.43	382,333	588,377
Norway	87	599	1.56	1,916,191	1,552,504
Poland	584	776	1.70	216,743	216,529
Portugal	242	188	1.19	163,830	137,704
Romania	209	845	1.34	171,379	153,741
Slovakia	152	726	1.35	216,850	203,772
Slovenia	91	666	1.10	189,347	142,437
Spain	957	529	1.34	448,584	364,320
Sweden	279	980	3.09	855,421	493,645
United Kingdom	839	6,750	1.65	8,159,246	3,469,543
Average	335	1,348	1.68	1,267,680	791,675

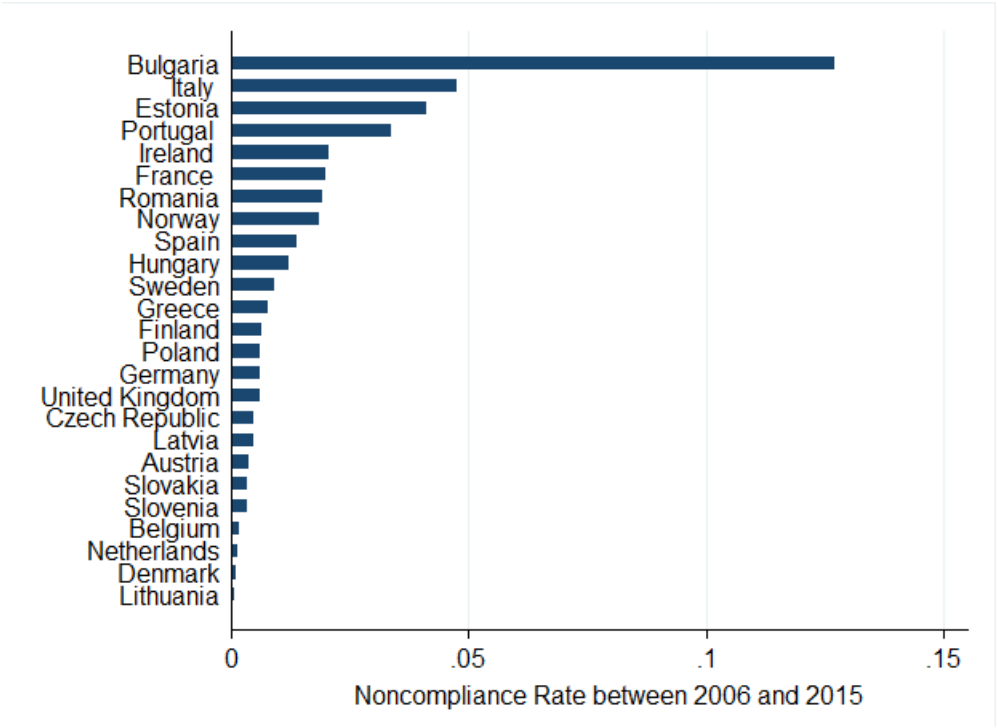
Notes: The table reports summary statistics of the financial variables of 8,156 firms used in the regressions by country. The data comes from Bureau Van Dijk's Orbis Database.

Table B.2: Descriptive Statistics: Number of Second-generation Immigrants from Each Source Country

Country of origin	Number of second-generation immigrants
Austria	333
Belgium	153
Czech Republic	382
Denmark	143
Estonia	38
Finland	315
France	520
Germany	1299
Greece	169
Hungary	347
Ireland	233
Italy	971
Latvia	78
Lithuania	80
Netherlands	187
Norway	128
Poland	835
Portugal	186
Romania	388
Slovakia	373
Slovenia	44
Spain	251
Sweden	149
United Kingdom	510

Notes: The table reports the number of second-generation immigrants from each country that I use to estimate inherited trust. The data comes from the European Social Survey.

Figure B.4: Noncompliance Rate between 2006 and 2015 (Excluding 2005)



Note: the plot shows variation in noncompliance rates across countries, excluding 2005. The data on compliance in the ETS is provided by the European Union Transaction Log (EUTL) at the installations level and I collapse the data over all years (excluding 2005) to calculate average compliance rates.

Table B.3: Trust and Noncompliance in the EU ETS between 2005 and 2015:
Robustness Checks for Country-level Analysis

	Dependent variable: Indicator for noncompliance							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Estimation method	IV Probit	IV Probit	IV Probit	IV Probit	IV Probit	IV Probit	IV Probit	Poisson
Trust measured	-0.814**	-0.923**	-0.835*	-0.869*	-0.871*	-0.837*	-0.699	-1.505*
in the country of operation	(0.351)	(0.454)	(0.451)	(0.483)	(0.465)	(0.453)	(0.430)	(0.878)
Observations	71,158	73,498	73,563	73,146	73,498	73,498	73,498	77,558
Firm-level controls (4)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Region-level controls (3)	Yes	No	No	No	No	No	No	No
Country-level controls (5)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies (10)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies (35)	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Clustering	Country	Country	Country	Country	Country	Country	Country	Country
Number of clusters	25	23	25	25	25	25	25	25
First stage F stat	35.3	55.7	60.2	61.0	61.8	70.4	37.5	

Notes: The dependent variable in each column is a binary noncompliance measure that takes 1 if the installation is out of compliance and 0 otherwise. Standard errors are clustered at the level shown in each column. "Industry dummies" are based on the main activity type information provided in the European Transaction Log. Column (1) adds region-level controls and column (2) drops ETS late jointers (Bulgaria and Romania) in my sample. Column (3) and (4) try an alternative measure of trust that I constructed as follows: I first regress trust on year dummies, form residuals, and then compute the means of these residuals by country. This measure takes into account year-specific shocks since I pool multiple waves conducted in different years to calculate the average level of trust in each country. In column (5) and (6), I construct another alternative measure for trust using the point estimates on country dummies from an individual-level regression (similarly as in column (5) and (6) in Table 4). The point estimates and associated standard errors are reported in Table A4. In column (7), I try an alternative specification for the instrument. Column (8) tries an alternative measure for noncompliance that measures the amount by which installations are noncompliant. * significant at 10%, ** significant at 5%, *** significant at 1%.

Table B.4: Alternative Measure of Trust: Coefficients on the Country Dummies from the European Social Survey

Dependent variable: Trust		
Country Indicator	Coefficient	SD
Austria	0.856***	(0.016)
Belgium	0.216***	(0.01)
Czech Republic	0.134***	(0.014)
Germany	Reference category	
Denmark	2.288***	(0.003)
Estonia	1.191***	(0.012)
Spain	0.453***	(0.018)
Finland	1.781***	(0.006)
France	-0.293***	(0.011)
United Kingdom	0.598***	(0.005)
Greece	-0.772***	(0.03)
Hungary	-0.185***	(0.014)
Ireland	0.744***	(0.006)
Italy	-0.087***	(0.032)
Lithuania	0.558***	(0.026)
Latvia	-0.095***	(0.045)
Netherlands	1.049***	(0.005)
Norway	1.823***	(0.006)
Poland	-0.507	(0.019)
Portugal	-0.314***	(0.058)
Romania	-0.129	(0.053)
Sweden	1.545***	(0.009)
Slovenia	-0.318***	(0.02)
Slovak Republic	-0.175	(0.018)
Observations: 283,181		
R-squared: 0.16		

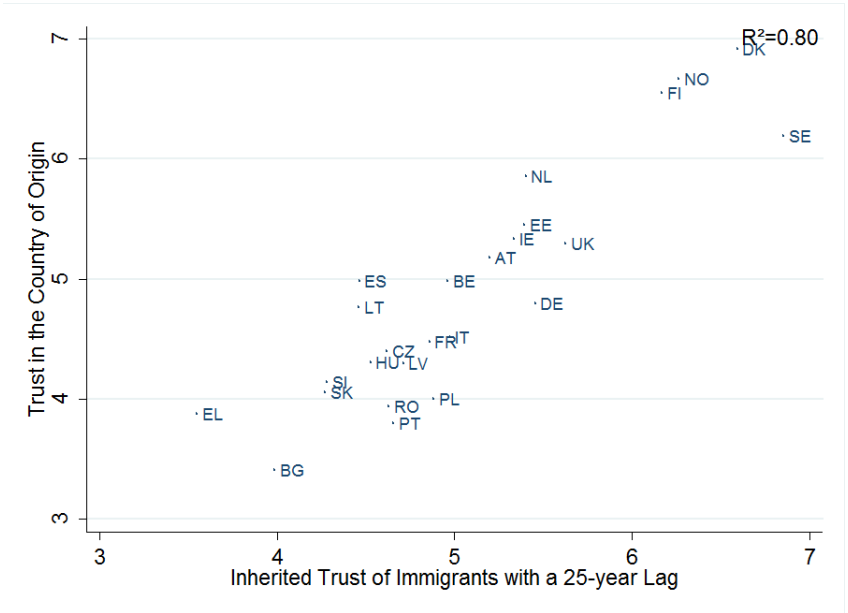
Notes: I report the point estimates on country dummies used as an alternative measure of trust across countries in column (5) and (6) in Table A3. The coefficients measure the level of trust in each country relative to Germany, which is the omitted reference category. Apart from the country dummies, the regression also included gender, age, education and income as well as year dummies (not reported). Standard errors are clustered at the country level. * significant at 10%, ** significant at 5%, *** significant at 1%.
Source: European Social Survey 2002 - 2014.

Table B.5: Alternative Measure of Trust: Coefficients on the Country Dummies from the World Value Survey

Dependent variable: Trust					
Country Indicator	Coefficient	SD	Country Indicator	Coefficient	SD
Australia	0.093***	(0.003)	Japan	0.014*	(0.008)
Brazil	-0.299***	(0.009)	South Korea	-0.100***	(0.006)
Bulgaria	-0.112***	(0.005)	Latvia	-0.138***	(0.010)
Canada	0.000	(0.01)	Mexico	-0.160***	(0.006)
Switzerland	0.055***	(0.005)	Malaysia	-0.283***	(0.005)
Chile	-0.201***	(0.007)	Netherlands	0.240***	(0.006)
China	0.204***	(0.005)	Norway	0.332***	(0.005)
Cyprus	-0.265***	(0.006)	Philippines	-0.335***	(0.013)
Czech Republic	-0.084***	(0.01)	Poland	-0.164***	(0.002)
Germany	Reference category		Romania	-0.220***	(0.002)
Estonia	-0.054***	(0.006)	Russian Federation	-0.112***	(0.002)
Spain	-0.123***	(0.006)	Saudi Arabia	0.114***	(0.023)
Finland	0.176***	(0.006)	Sweden	0.255***	(0.006)
France	-0.164***	(0.01)	Singapore	-0.107***	(0.012)
Hong Kong	0.081***	(0.005)	Slovenia	-0.179***	(0.004)
Hungary	-0.071***	(0.01)	Slovakia	-0.100***	(0.011)
Indonesia	0.069***	(0.008)	Turkey	-0.260***	(0.01)
Israel	-0.182***	(0.024)	Ukraine	-0.085***	(0.003)
India	-0.08***	(0.007)	United Kingdom	-0.067***	(0.006)
Italy	-0.037***	(0.01)	United States	-0.020***	(0.006)
Jordan	-0.136***	(0.007)	South Africa	-0.187***	(0.009)
Observations: 263,695					
R-squared: 0.109					

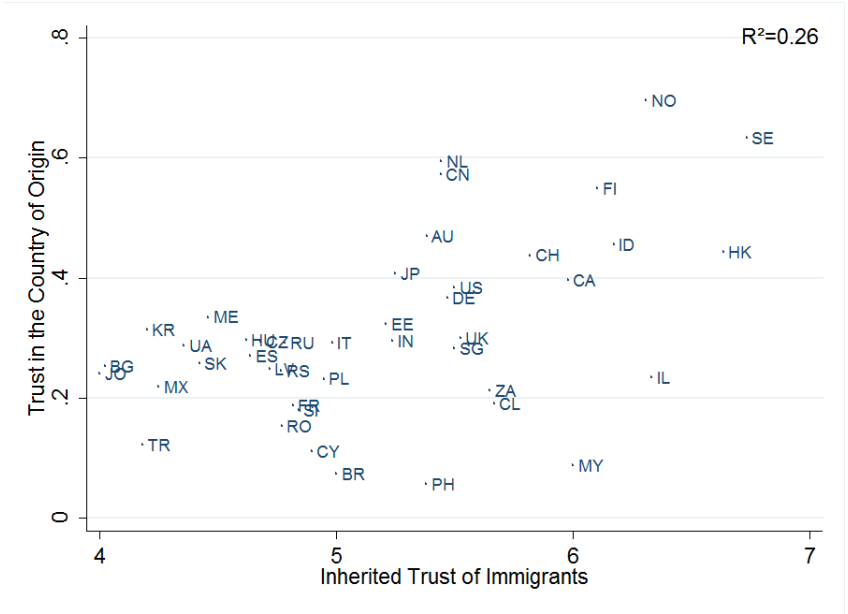
Notes: I report the point estimates on country dummies used as an alternative measure of trust across countries in column (6) in Table 5. The coefficients measure the level of trust in each country relative to Germany, which is the omitted reference category. Apart from the country dummies, the regression also included gender, age, education and income as well as year dummies (not reported). Standard errors are clustered at the country level. * significant at 10%, ** significant at 5%, *** significant at 1%.
Source: World Value Survey 1981 - 2013.

Figure B.5: Correlation between Trust in Source Country and Inherited Trust with a 25-year Lag



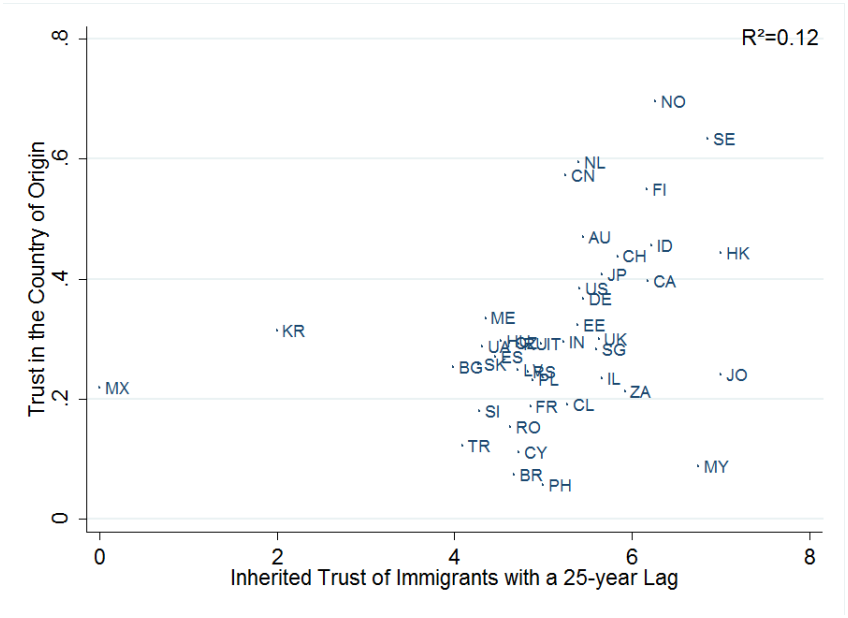
Note: the plot shows a correlation between inhered trust of second-generation immigrants and the level of trust in their countries of origin. These measures are constructed based on the following survey question "Generally speaking, would you say that most people can be trusted, or that you can't be too careful in dealing with people?" in the European Social Survey (2002-2014).

Figure B.6: Global: Correlation between Trust in Source Country and Inherited Trust



Note: the plot shows a correlation between inhered trust of second-generation immigrants and the level of trust in their countries of origin. The average trust measure across countries in the global sample is based on the World Value Survey (1984-2014). The inherited trust measure is constructed based on the European Social Survey (2002-2014).

Figure B.7: Global: Correlation between Trust in Source Country and Inherited Trust with a 25-year Lag



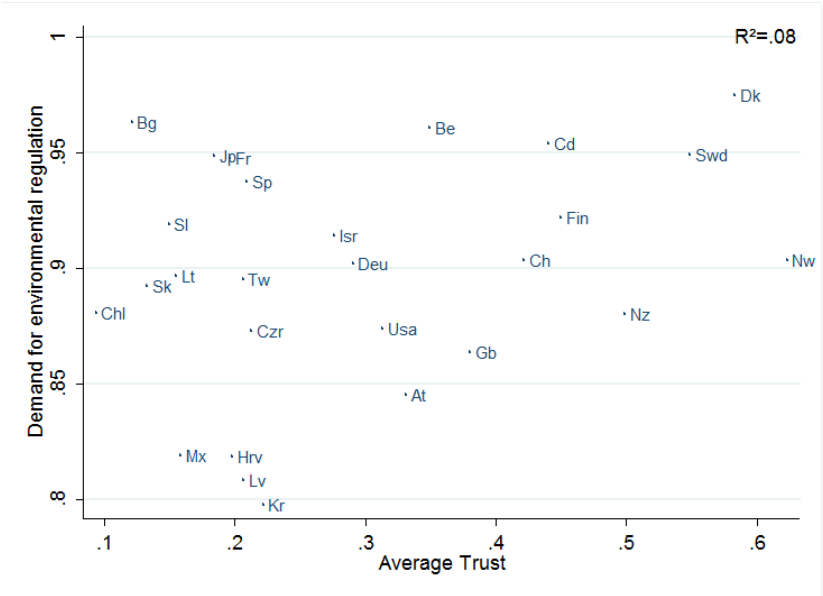
Note: the plot shows a correlation between inhered trust of second-generation immigrants and the level of trust in their countries of origin. The average trust measure across countries in the global sample is based on the World Value Survey (1984-2014). The inherited trust measure is constructed based on the European Social Survey (2002-2014).

Table B.6: Correlation between trust and measures of climate policy

	Voluntary policy		Involuntary policy	
	(1)	(2)	(3)	(4)
Average trust	9.650***	12.139***	11.043***	1.895
	(2.233)	(3.158)	(2.453)	(1.106)
Log per capita GDP		-5.011		18.147***
		(4.495)		(1.445)
Share of population		-0.159		-0.151**
with tertiary education		(0.209)		(0.065)
Observations	30	30	27	27
R-squared	0.40	0.43	0.44	0.94

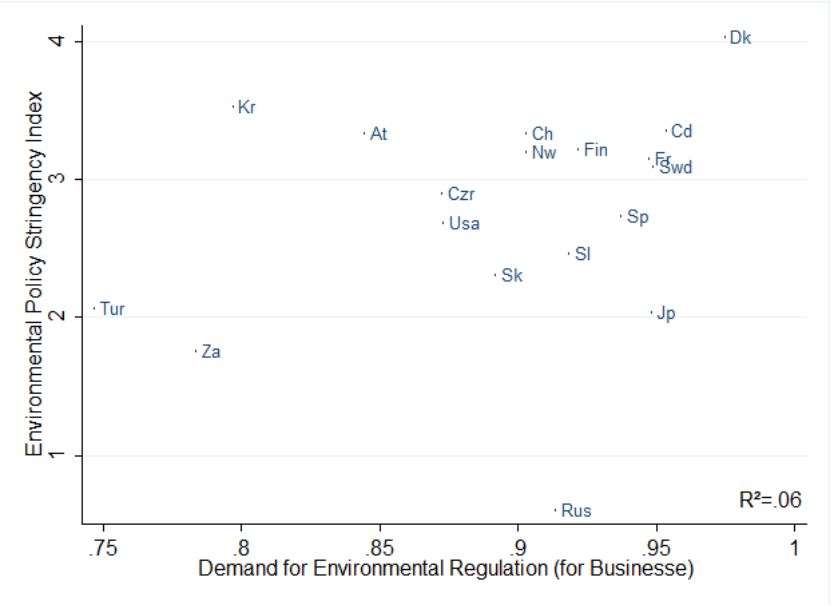
Notes: The table reports macro-level correlations between trust and different measures of climate policy stringency. The dependent variable in column (1) and (2) is a measure of voluntary climate policy measured by target shares of renewable energy in total consumption by 2020. The dependent variable in column (3) and (4) is a measure of involuntary (assigned) climate policy represented by emission targets for 2020 set by the Effort Sharing Decision at the EU level. Data on per capita GDP and education comes from the Eurostat.

Figure B.8: Correlation between Trust and Demand for Environmental Regulations



Note: the graph plots the relationship between trust and public demand for environmental regulations. Data on both measures comes from the International Social Survey Programme (2010).

Figure B.9: Correlation between Demand and the Stringency of Environmental Regulations



Note: the graph plots the relationship between the public demand for and the stringency of environmental regulations measured by the OECD Environmental Policy Stringency Index.. The data on the public demand comes from the International Social Survey Programme (2010).

B.3 Proofs

The presence of the threshold type The existence of a cutoff type θ^*, above which all types violate and below which all types comply with the regulation, directly follows from the monotonicity of firms' actions. Firm i chooses an action b_i to maximize its expected payoff written as:

$$\mathbb{E}u_i(b_i, \theta_i) = -a(b_i - \theta_i)^2 - (1-a)(b_i - B_j)^2 - \gamma \sum_{i \in N} b_i \qquad \text{if } b_i \leq L \tag{B.1}$$

$$\begin{aligned}\mathbb{E}u_i(b_i, \theta_i) = &-\mu[a(L - \theta_i)^2 + (1-a)(L - B_j)^2 + \phi] \\ &- (1-\mu)[a(b_i - \theta_i)^2 + (1-a)(b_i - B_j)^2] - \gamma \sum_{i \in N} b_i \qquad \text{if } b_i > L\end{aligned} \tag{B.2}$$

where (3) represents the expected payoff of abiding by the law and (4) represents the expected payoff of violating the law.

The first order conditions are:

$$b_i = \min[a\theta_i + (1-a)B_j - \frac{\gamma}{2}, L] \qquad \text{if } b_i \leq L \tag{B.3}$$

$$b_i = a\theta_i + (1-a)B_j - \frac{\gamma}{2} \qquad \text{if } b_i > L \tag{B.4}$$

Note that both (5) and (6) are nondecreasing in θ_i and (6) is always greater than (5). Thus, the only possible violation of the monotonicity property is where the payoff-maximizing action at θ_i is smaller than (or equal to) L, while at $\theta_i' < \theta_i$ the payoff-maximizing action is greater than L. To rule out this scenario, it suffices to show that for any b_{low} and b_{high} such that $b_{\text{low}} \leq L$ and $b_{\text{high}} > L$, $\mathbb{E}u_i(b_{\text{high}}, \theta_i) - \mathbb{E}u_i(b_{\text{low}}, \theta_i)$ is increasing in θ_i.

From (2) and (3), it follows that

$$\begin{aligned}\mathbb{E}u_i(b_{\text{high}}, \theta_i) - \mathbb{E}u_i(b_{\text{low}}, \theta_i) = &-\mu[a(L - \theta_i)^2 + (1-a)(L - B_j)^2 + \phi] \\ &- (1-\mu)[a(b_{\text{high}} - \theta_i)^2 + (1-a)(b_{\text{high}} - B_j)^2] + a(b_{\text{low}} - \theta_i)^2 + (1-a)(b_{\text{low}} - B_j)^2\end{aligned} \tag{B.5}$$

Differentiating with respect to θ_i yields:

$$2a\mu(L - b_{\text{high}}) + 2a(b_{\text{high}} - b_{\text{low}}) \tag{B.6}$$

It is straightforward to see that the above expression is positive given the definition of b_{low} and b_{high} that are smaller (or equal to) and greater than L, respectively for any $a \in [0,1]$ and $\mu \in [0,1]$. From this monotonicity property, the existence of the threshold θ^* follows. QED

θ^* as a decreasing function of B_j I characterize the expression for a threshold θ^*

by balancing the costs and benefits of violating the regulation for the threshold firm at θ^*.

Suppose that firm θ^* decides to violate the regulation. Then the expected payoff will be:

$$\begin{aligned} &-\mu[a(L-\theta^*)^2+(1-a)(L-B_j)^2+\phi] \\ &-(1-\mu)[a(a\theta^*+(1-a)B_j-\frac{\gamma}{2}-\theta^*)^2+(1-a)(a\theta^*+(1-a)B_j-\frac{\gamma}{2}-B_j)^2] \end{aligned} \tag{B.7}$$

Suppose instead that firm θ^* decides to abide by the regulation.

$$-a(L-\theta^*)^2-(1-a)(L-B_j)^2 \tag{B.8}$$

The threshold θ^* is given by setting (11) equal to (12). Differentiating both sides of the resulting equation with respect to B yields:

$$a(L-\theta)\frac{\partial\theta^*}{\partial B_j}+(1-a)(L-B_j)=-a(1-a)(\theta^*-B_j)(\frac{\partial\theta^*}{\partial B_j}-1) \tag{B.9}$$

Solving for $\frac{\partial\theta^*}{\partial B_j}$ and simplifying the expression yields $1-\frac{1}{a}$, which is negative for any $a\in[0,1)$.

QED

B.4 Further Data Description

Trust

European Social Survey I build trust measures using the European Social Survey (ESS), a collection of cross-country surveys on the individual beliefs, values and social norms as well as basic demographic information of respondents such as age, education, religion and occupation, etc. I pool data from the seven waves collected so far (from 2002 to 2014), which includes all European countries in my sample.

The survey elicits trust of respondents 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?" Answers are given on a scale of 0 to 10, where 0 implies "You can't be too careful" and 10 means "Most people can be trusted". The frequency of individual responses used to build the trust measure by country and wave is reported in Table C1.

World Value Survey In Section 2.5.2, I exploit the difference in the country where the regulated installations' global headquarters are located, which include a number of non-European countries. For this specification, I rely on the World Value Survey for the data on trust since its geographic coverage is world-wide, while the ESS covers Europe only. The WVS allows me to exploit the geographical variation in trust across 44 countries shown in Table A5.

The WVS measures trust by asking the exact same question that appears in the ESS, which makes the two measures based on the two surveys reasonably comparable. The only difference is that the answer to the trust question in the WVS is binary, while the ESS uses a scale of 0 to 10.

Similarly as with the ESS, I pool together seven successive waves administered so far (1984-2014) and compute the country level trust by taking the simple average over all observations available for each country available across all waves. The frequency of individual responses used to build the trust measure by country and wave is reported in Table C2.

European Commission Bilateral Trust The data on bilateral trust between a pair of countries directly comes from Panel A in Table 1 of Guiso et al. (2009). The data is collected in a series of Eurobarometer surveys commissioned by the European Commission. They ask the following question, "I would like to ask you a question about how much trust you have in people from various countries. For each, please tell me whether you have a lot of trust, some trust, not very much trust, or no trust at all." This was asked to all European Union Member States about each other and a number of

other countries (including the United States, China, and Japan). I use the average level of trust country A has for country B to predict the probability of noncompliance of an installation operating in country B but owned by a multinational firm headquartered in country A.

Compliance in the ETS

The data on compliance behavior in the EU ETS is provided by the European Union Transaction Log (EUTL), a system harmonized at the EU level that publishes information on permit allocation, verified emissions and surrendered allowances at the installation level. I drop countries with less than 50 installations (Cyprus, Iceland, Liechtenstein, Malta, and Luxembourg). The number of installations in each country is reported in Table C3.

In addition to this detailed information, the EUTL also automatically calculates the compliance status of each installation. There are five possible codes installations can be given: (1) A, which implies "the number of allowances and ERUs/CERs surrendered by 30 April is greater than or equal to verified emissions.", (2) B, which implies "the number of allowances and ERUs/CERs surrendered by 30 April is lower than verified emissions.", (3) C, which implies "verified emissions were not entered until 30 April.", (4) D, which implies "verified emissions were corrected by competent authority after 30 April of year X. The competent authority of the Member State decided that the installation is not in compliance for year X-1.", and (5) E, which implies "verified emissions were corrected by competent authority after 30 April of year X. The competent authority of the Member State decided that the installation is in compliance for year X-1." CERs refer to Certified Emission Reductions and ERUs refer to Emission Reduction Units (ERUs) from the Clean Development Mechanism (CDM) and Joint Implementation (JI) that can be used as permits in the ETS.

Country-level controls

Governance indicators I use two governance indicators developed by the World Bank to control for law enforcement or institutional capacity between 2005 and 2015. One is a measure of country-wide 'rule of law' defined as "perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence". The values range between -0.171 and 2.12 in my sample. The second measure is the perceived regulatory quality defined as "perceptions of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development". The values range between 0.213 and 1.921 in my sample. The data can be accessed at: http://data.worldbank.org/data-

catalog/worldwide-governance-indicators.

Economic controls For country-level economic controls, I use GDP per capita in Euro, the percentage of population with tertiary education and total population between 2005 and 2015. The data comes from the Eurostat. Descriptive statistics for all country-level controls is reported in Table C5.

Region-level controls

I follow the NUTS classification (Nomenclature of territorial units for statistics) to define regions in Europe. For most countries, areas at NUTS 2 level are considered as regions, while I use NUTS 1 level for some countries (France, Germany, Greece, Poland, Romania, Spain, and Belgium) in order keep the number of regions within countries relatively comparable across countries (for instance, if I apply NUTS 2 for Germany there will be 39 regions in Germany when on average there are 6.5 regions in each country). The three Baltic countries (Estonia, Latvia, and Lithuania) are only broken down to NUTS 3 level (with NUTS 2 level being the entire territory) and most regional statistics by the Eurostat is only available at NUTS 2 level. Thus region-level controls for these countries are unavailable. The economic data at region level comes from the Eurostat. Descriptive statistics for all region-level controls as well as the number of regions in each country are reported in Table C6.

Table B.7: European Social Survey: Number of Respondents

Country	Wave 1	Wave 2	Wave 3	Wave 4	Wave 5	Wave 6	Wave 7	Total
Austria	2,257	2,256	2,405	2,255	2,259	0	1,795	13,227
Belgium	1,899	1,778	1,798	1,760	1,704	1,869	1,769	12,577
Bulgaria	0	0	1,400	2,230	2,434	2,260		8,324
Czech Republic	1,360	3,026	0	2,018	2,386	2,009	2,148	12,947
Denmark	1,506	1,487	1,505	1,610	1,576	1,650	1,502	10,836
Estonia	0	1,989	1,517	1,661	1,793	2,380	2,051	11,391
Finland	2,000	2,022	1,896	2,195	1,878	2,197	2,087	14,275
France	1,503	1,806	1,986	2,073	1,728	1,968	1,917	12,981
Germany	2,919	2,870	2,916	2,751	3,031	2,958	3,045	20,490
Greece	2,566	2,406	0	2,072	2,715	0	0	9,759
Hungary	1,685	1,498	1,518	1,544	1,561	2,014	1,698	11,518
Ireland	2,046	2,286	1,800	1,764	2,576	2,628	2,390	15,490
Italy	1,207	1,529	0	0	0	960	0	3,696
Latvia	0	0	1,960	1,980	0	0	0	3,940
Lithuania	0	0	0	2,002	1,677	2,109	2,250	8,038
Netherlands	2,364	1,881	1,889	1,778	1,829	1,845	1,919	13,505
Norway	2,036	1,760	1,750	1,549	1,548	1,624	1,436	11,703
Poland	2,110	1,716	1,721	1,619	1,751	1,898	1,615	12,430
Portugal	1,511	2,052	2,222	2,367	2,150	2,151	1,265	13,718
Romania	0	0	2,139	2,146	0	0	0	4,285
Slovakia	0	1,512	1,766	1,810	1,856	1,847	0	8,791
Slovenia	1,519	1,442	1,476	1,286	1,403	1,257	1,224	9,607
Spain	1,729	1,663	1,876	2,576	1,885	1,889	1,925	13,543
Sweden	1,999	1,948	1,927	1,830	1,497	1,847	1,791	12,839
United Kingdom	2,052	1,897	2,394	2,352	2,422	2,286	2,264	15,667

Source: European Social Survey (ESS, 2002-2014).

Table B.8: World Value Survey: Number of Respondents

Country	Wave 1	Wave 2	Wave 3	Wave 4	Wave 5	Wave 6	Total
Australia	1,228	0	2,048	0	1,421	1,477	6,174
Brazil	0	1,782	0	0	1,500	1,486	4,768
Bulgaria	0	0	1,072	0	1,001	0	2,073
Canada	0	0	0	1,931	2,164	0	4,095
Chile	0	1,500	1,000	1,200	1,000	1,000	5,700
China	0	1,000	1,500	1,000	1,991	2,300	7,791
Cyprus	0	0	0	0	1,050	1,000	2,050
Czech Republic	0	924	1,147	0	0	0	2,071
Estonia	0	0	1,021	0	0	1,533	2,554
Finland	1,003	0	987	0	1,014	0	3,004
France	0	0	0	0	1,001	0	1,001
Germany	0	0	2,026	0	2,064	2,046	6,136
Hong Kong	0	0	0	0	1,252	1,000	2,252
Hungary	1,464	0	650	0	1,007	0	3,121
India	0	2,500	2,040	2,002	2,001	5,659	14,202
Indonesia	0	0	0	1,000	2,015	0	3,015
Israel	0	0	0	1,199	0	0	1,199
Italy	0	0	0	0	1,012	0	1,012
Japan	1,204	1,011	1,054	1,362	1,096	2,443	8,170
Jordan	0	0	0	1,223	1,200	1,200	3,623
Korea, Republic of	970	1,251	1,249	1,200	1,200	1,200	7,070
Latvia	0	0	1,200	0	0	0	1,200
Malaysia	0	0	0	0	1,201	1,300	2,501
Mexico	1,837	1,531	2,364	1,535	1,560	2,000	10,827
Netherlands	0	0	0	0	1,050	1,902	2,952
New Zealand	0	0	1,201	0	954	841	2,996
Norway	0	0	1,127	0	1,025	0	2,152
Pakistan	0	0	733	0	0	0	733
Philippines	0	0	1,200	1,200	0	1,200	3,600
Poland	0	938	1,153	0	1,000	966	4,057
Romania	0	0	1,239	0	1,776	1,503	4,518
Russian Federation	0	1,961	2,040	0	2,033	2,500	8,534
Saudi Arabia	0	0	0	1,502	0	0	1,502
Singapore	0	0	0	1,512	0	1,972	3,484
Slovakia	0	466	1,095	0	0	0	1,561
Slovenia	0	0	1,007	0	1,037	1,069	3,113
South Africa	1,596	2,736	2,935	3,000	2,988	3,531	16,786
Spain	0	1,510	1,211	1,209	1,200	1,189	6,319
Sweden	954	0	1,009	1,015	1,003	1,206	5,187
Switzerland	0	1,400	1,212	0	1,241	0	3,853
Turkey	0	1,030	1,907	3,401	1,346	1,605	9,289
Ukraine	0	0	2,811	0	1,000	1,500	5,311
United Kingdom	0	0	1,093	0	1,041		2,134
United States	2,325	0	1,542	1,200	1,249	2,232	8,548

Source: World Value Survey (WVS, 1984-2014).

Table B.9: Number of Installations in the ETS by Country

Country	Number of installations
Austria	275
Belgium	481
Bulgaria	172
Czech Republic	464
Denmark	455
Estonia	65
Finland	679
France	1,520
Germany	2,532
Greece	207
Hungary	287
Ireland	215
Italy	1,482
Latvia	118
Lithuania	124
Netherlands	622
Norway	173
Poland	1,020
Portugal	358
Romania	284
Slovakia	221
Slovenia	104
Spain	1,362
Sweden	875
United Kingdom	1,373
Total	15,468

Source: European Union Transaction Log (EUTL).

Table B.10: Descriptive Statistics: Country-level Variables

Country	Rule of law	Regulatory quality	GDP per capita (Euro)	Tertiary education (level 3-8, %)	Population
Austria	1.870	1.528	35,645	76.9	8,368,325
Belgium	1.360	1.291	33,591	67.5	10,861,533
Bulgaria	- 0.120	0.600	5,045	73.9	7,429,690
Czech Republic	0.962	1.134	14,300	85.5	10,406,087
Denmark	1.956	1.821	44,009	70.4	5,530,786
Estonia	1.153	1.440	12,273	81.9	1,333,244
Finland	1.974	1.769	35,573	76.7	5,352,147
France	1.442	1.202	30,909	68.7	64,631,834
Germany	1.696	1.571	32,673	79.0	81,483,174
Greece	0.593	0.667	18,855	62.5	11,025,804
Hungary	0.721	1.023	10,018	75.3	9,990,034
Ireland	1.729	1.707	41,555	69.4	4,469,781
Italy	0.377	0.840	26,773	53.9	59,184,429
Latvia	0.748	1.020	9,882	79.8	2,117,490
Lithuania	0.756	1.074	9,918	82.9	3,120,577
Netherlands	1.822	1.751	37,791	69.1	16,578,149
Norway	1.950	1.495	66,745	74.8	4,868,568
Poland	0.620	0.914	9,218	81.8	38,085,752
Portugal	1.055	0.926	16,445	34.6	10,512,146
Romania	0.014	0.545	6,336	69.5	20,479,399
Slovakia	0.503	1.015	11,927	83.4	5,392,052
Slovenia	0.962	0.738	17,418	79.5	2,035,400
Spain	1.077	1.068	22,845	52.1	45,787,350
Sweden	1.930	1.713	40,409	75.8	9,345,354
United Kingdom	1.715	1.744	32,909	75.6	62,513,575
Average	1.116	1.195	24,355	72.142	19,430,388

Source: Eurostat and the World Bank.

Table B.11: Descriptive Statistics: Region-level Variables

country	Number of regions	GDP per capita (Euro)	Education (level 5-8)	Population
Austria	9	34,627	19.8	929,814
Belgium	3	40,058	36.8	3,620,511
Bulgaria	6	4,508	22.2	1,238,282
Czech Republic	8	14,389	17.0	1,300,761
Denmark	5	40,265	31.9	909,087
Finland	5	36,493	36.1	1,070,429
France	9	27,850	27.4	7,130,197
Germany	16	30,904	26.4	5,004,642
Greece	4	18,182	23.1	2,756,451
Hungary	7	8,792	18.2	1,427,148
Ireland	2	35,955	35.1	2,234,890
Italy	5	26,024	14.6	11,836,886
Netherlands	12	35,096	30.5	1,381,512
Norway	7	55,450	35.6	695,510
Poland	6	8,726	21.4	6,347,625
Portugal	7	16,155	15.0	1,501,735
Romania	4	6,599	14.2	5,242,526
Slovakia	4	14,482	19.7	1,348,013
Slovenia	2	17,673	28.6	187,453
Spain	7	22,657	31.0	6,541,050
Sweden	8	38,269	32.3	1,168,169
United Kingdom	12	30,950	34.1	4,671,064
Average	6.5	24,964	25.6	3,073,368

Source: Eurostat.

Appendix C

Appendix to Chapter 3

Table C.1: Descriptive statistics: social relations and interactions

	Urban areas	Rural areas	
	Mean	Mean	Diff.
Favors	2.37	2.63	0.25***
Watch over house	2.49	2.64	0.14***
Advice on family matters	2.07	2.33	0.25***
Parties	2.12	2.38	0.25***
Gathering	2.12	2.43	0.31***

NOTE: Each variable is an answer to (1): "How often do people from your community do favors to each other?", (2): "When a neighbor is away, how often do you or your neighbors watch his/her house?", (3): "How often do you and other people from your community ask for advice to each other about things like raising your children or getting a new job?", (4): "How often do people from your community have parties in which you invite other people from the community?", and (5): "How often do you and other people from your community gather in each other's houses or on the street?" in 2009 wave of the MXFLS. Respondents answer the questions by choosing from "Never", "Rarely", "Frequently" or "Always". Higher values correspond to higher frequency. *** p<0.01, ** p<0.05, * p<0.1

Table C.2: Heterogeneity: the effect of out-migration on other measures of social capital

Dependent variables	(1)	(2)	(3)	(4)	(5)	(6)
	Help		Value sharing		Index	
	Urban	Rural	Urban	Rural	Urban	Rural
Out-migration rate	-3.621***	1.829	-4.166***	0.021	-7.819***	-0.358
	(1.288)	(4.115)	(1.471)	(6.050)	(2.945)	(10.067)
Exogenous controls	Yes	Yes	Yes	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
First-stage F-statistics	52.72	4.074	55.70	3.579	55.25	3.471
Number of municipalities	103	73	102	73	100	73
Observations	3,319	2,885	3,061	2,776	2,945	2,736
R-squared	0.007	0.036	0.008	0.029	0.009	0.030

NOTE: Each regression includes the full set of exogenous controls and state fixed effects. *Willingess to Help* is the answer to the following statement: "people around here are willing to help their neighbors". *Value Sharing* is the answer to the following statement: "people from this neighborhood share the same values". *Index* is created based on the four social capital measures, trust, willingness to help and value sharing. Standard errors are in parentheses and clustered at the municipality level. *** p<0.01, ** p<0.05, * p<0.1

C.1 Net- and in-migration

While out-migration has a strong theoretical prediction for its negative impact on trust, in-migration is expected to have indirect effects through increased population density or urbanisation. As I discussed in Section 3.2 it could also have substantial effects if migrants are ethnically and linguistically distinct and therefore find it more difficult to integrate into pre-existing community social networks. However, overall its impact is expected to be small given the ethnic and linguistic homogeneity of Mexico. As for the role of pre-existing social networks, I later investigate it further in the heterogeneity section. Net-migration is then expected to have ambiguous or, if anything, positive effects on trust as it is negatively correlated with out-migration or no significance at all since, as what matters is the changes in the composition rather than the absolute size of the population. In this section, I explore the distinct effects of net- and in-migration and find empirical support for the above theoretical conjectures. For the net-migration variable, I use both the predicted in- and out-migration (that excludes within-state migrants) as instruments and for the in-migration variable, I only include the predicted in-migration rate as an instrument. There exists a concern, however, for the exclusion restriction being violated in the case of predicted in-migration flows if the inflows based on settlement pattern observed 10 years ago are correlated with the recent changes in trust between existing residents (note that the dependent variable is in first-difference). Given the original hypothesis that migration inflows dilute trust established by existing residents through increased population density and therefore negatively affect trust, predicted in-migration flows based on historical settlement pattern would drive the estimates upward if people are more likely to trust immigrants from their own origin areas. However, as I present later the IV estimate for the in-migration rates are lower than OLS estimate, not higher, which alleviates this concern.

[Table C.3]

Table C.3 shows the results from the first-stages of the IV estimation for the net- and in-migration. In both regressions, the instruments display expected signs and have strong predictory power over the actual migration flows. For net-migration, the predicted in- and out-migration rate are positively and negatively related, respectively, with the endogenous variable and have the F-statistics on the joint significance around 19.6 (column 1). The predicted in-migration rate also appears to be a strong predictor of the actual in-migration rate (column 2).

[Table A4]

Table C.4 presents the IV estimation results for the effects of net-migration and in-migration on trust. As predicted, net-migration has a weak and positive impact on trust among neighbors. The effect of in-migration is negative but statistically insignificant. In column 3, I present the results from the IV estimation that includes both out- and

in-migration rates with corresponding instruments. The first stage results from this just-identified 2sls estimation with two endogenous variables are presented in Table C.5. This specification does not alter the results. The coefficients change very little and especially the out-migration rate variable displays a very similar coefficient to the one reported in column 2, Table 3.3 in the main text. The analysis here again points to a negative and statistically significant impact of out-migration on how much individuals trust each other.

Table C.3: First-stage regressions: relation between predicted and actual migration, 2005-2010

	(1) Net-migration rate	(2) In-migration rate
Predicted out-migration rate	-1.366***	
	(0.242)	
Predicted in-migration rate	1.177***	1.052***
	(0.269)	(0.257)
First-stage F-statistics	19.6	14.8
Exogenous controls	Yes	Yes
State fixed effects	Yes	Yes
Number of municipalities	152	152
Observations	6,158	6,158
R-squared	0.346	0.412

NOTE: Regressions include all exogenous controls from the second stage and state fixed effects. Standard errors are in parentheses and clustered at the municipality level. *** p<0.01, ** p<0.05, * p<0.1

Table C.4: The effect of net- and in-migration on trust: Mexico, 2005-2010

	(1) FD-IV	(2) FD-IV	(3) FD-IV
Net-migration rate	0.775*		
	(0.462)		
In-migration rate		-0.941	-0.838
		(1.216)	(1.174)
Out-migration rate			-1.932**
			(0.922)
Exogenous controls	Yes	Yes	Yes
State fixed effects	Yes	Yes	Yes
Number of municipalities	152	152	152
Observations	6,158	6,158	6,158
R-squared	0.010	0.009	0.009

NOTE: Each regression includes state fixed effects. *Trust* is the answer to the following statement: "People from this locality/community are trustworthy." Standard errors are in parentheses and clustered at the municipality level. *** p<0.01, ** p<0.05, * p<0.1

Table C.5: First-stage regressions: with two endogenous variables

	(1) Out-migration rate	(2) In-migration rate
Predicted out-migration rate	1.180***	-0.187
	(0.199)	(0.163)
Predicted in-migration rate	-0.100	1.076***
	(0.193)	(0.275)
Exogenous controls	Yes	Yes
State fixed effects	Yes	Yes
First-stage F-statistics	17.73	8.33
Number of municipalities	152	152
Observations	6,158	6,158
R-squared	0.488	0.417

NOTE: The results are from the first stage regressions of just-identified 2sls estimation with two endogenous variables (out- and in-migration rates). Regressions include all exogenous controls from the second stage and state fixed effects. Standard errors are in parentheses and clustered at the municipality level. *** p<0.01, ** p<0.05, * p<0.1

References

Acemoglu, D. and Jackson, M. O. (2017). Social norms and the enforcement of laws. *Journal of the European Economic Association*, 15(2):245–295.

Acosta, P. A., Fajnzylber, P., and Lopez, H. (2007). The impact of remittances on poverty and human capital: evidence from latin american household surveys.

Adger, W. N. (2006). *Fairness in adaptation to climate change*. MIT press.

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

Akai, K. and Netzer, R. J. (2012). Trust and reciprocity among international groups: Experimental evidence from Austria and Japan. *The Journal of Socio-Economics*, 41(2):266–276.

Alesina, A., Algan, Y., Cahuc, P., and Giuliano, P. (2015). Family values and the regulation of labor. *Journal of the European Economic Association*, 13(4):599–630.

Alesina, A. and La Ferrara, E. (2000). Participation in heterogeneous communities. *The Quarterly Journal of Economics*, 115(3):847–904.

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

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

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

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

Angelucci, M. (2015). Migration and financial constraints: Evidence from mexico. *Review of Economics and Statistics*, 97(1):224–228.

Angelucci, M., De Giorgi, G., Rangel, M. A., Rasul, I., et al. (2009). *Village economies and the structure of extended family networks*. Centre for Economic Policy Research.

Antman, F. M. (2011). International migration and gender discrimination among children left behind. *The American Economic Review*, 101(3):645–649.

Arguedas, C. and Rousseau, S. (2012). Learning about compliance under asymmetric information. *Resource and Energy Economics*, 34(1):55–73.

Arrow, K. J. (1972). Gifts and exchanges. *Philosophy & Public Affairs*, pages 343–362.

Banerjee, P. and Shogren, J. F. (2010). Regulation, reputation, and environmental risk. *Economics Letters*, 106(1):45–47.

Barro, R. (2003). Religion adherence data.

Bellows, J. and Miguel, E. (2009). War and local collective action in Sierra Leone. *Journal of Public Economics*, 93(11):1144–1157.

Bergin, P. R., Feenstra, R. C., and Hanson, G. H. (2009). Offshoring and volatility: Evidence from mexico's maquiladora industry. *American Economic Review*, 99(4):1664–71.

Bertrand, M., Duflo, E., and Mullainathan, S. (2004). How much should we trust differences-in-differences estimates? *The Quarterly Journal of Economics*, pages 249–275.

Besley, T., Coate, S., and Loury, G. (1993). The economics of rotating savings and credit associations. *The American Economic Review*, pages 792–810.

Binzel, C. and Fehr, D. (2013). Social distance and trust: Experimental evidence from a slum in cairo. *Journal of Development Economics*, 103:99–106.

Bloom, N., Sadun, R., and Van Reenen, J. (2012a). Americans do IT better: US multinationals and the productivity miracle. *The American Economic Review*, 102(1):167–201.

Bloom, N., Sadun, R., and Van Reenen, J. (2012b). The organization of firms across countries. *The Quarterly Journal of Economics*, 127(4):1663–1705.

Bloom, N. and Van Reenen, J. (2007). Measuring and explaining management practices across firms and countries. *The Quarterly Journal of Economics*, 122(4):1351–1408.

Bolt, J. and van Zanden, J. L. (2014). The maddison project: collaborative research on historical national accounts. *The Economic History Review*.

Botta, E. and Koźluk, T. (2014). Measuring environmental policy stringency in oecd countries: A composite index approach. *OECD Economics Department Working Papers*.

Boustan, L. P., Fishback, P. V., and Kantor, S. (2010). The Effect of Internal Migration on Local Labor Markets:American Cities during the Great Depression. *Journal of Labor Economics*, 28(4):719–746.

Brehm, J. and Hamilton, J. T. (1996). Noncompliance in environmental reporting: Are violators ignorant, or evasive, of the law? *American Journal of Political Science*, pages 444–477.

Brunel, C. and Johnson, E. P. (2017). Two birds and one stone? local pollution regulation and greenhouse gas emissions. *Mimeo*.

Burstein, A. T., Monge-Naranjo, A., et al. (2009). Foreign know-how, firm control, and the income of developing countries. *The Quarterly Journal of Economics*, 124(1):149–195.

Butler, J. V., Giuliano, P., and Guiso, L. (2016). The right amount of trust. *Journal of the European Economic Association*, 14(5):1155–1180.

Calel, R. and Dechezleprêtre, A. (2016). Environmental policy and directed technological change: evidence from the European carbon market. *Review of Economics and Statistics*, 98(1):173–191.

Carattini, S., Baranzini, A., and Roca, J. (2015). Unconventional determinants of greenhouse gas emissions: the role of trust. *Environmental Policy and Governance*, 25(4):243–257.

Carattini, S. and Jo, A. (2017). Trust and CO2 emissions: Cooperation on a global scale. *Mimeo*.

Cohen, B., Stren, R., Montgomery, M. R., Reed, H. E., et al. (2003). *Cities Transformed:: Demographic Change and Its Implications in the Developing World*, volume 2. National Academies Press.

Cohen, F. and Dechezleprêtre, A. (2015). Temperature, Mortality and Income Inequality: Evidence from Mexico. *Manuscript*.

Cohen, M. A. (1998). Monitoring and enforcement of environmental policy. *Manuscript, Owen Grad. School Management, Vanderbilt Univ.*

Dal Bó, P. (2005). Cooperation under the shadow of the future: experimental evidence from infinitely repeated games. *The American Economic Review*, 95(5):1591–1604.

Dal Bó, P. (2007). Social norms, cooperation and inequality. *Economic Theory*, 30(1):89–105.

Dasgupta, S., Hettige, H., and Wheeler, D. (2000). What improves environmental compliance? evidence from Mexican industry. *Journal of Environmental Economics and Management*, 39(1):39–66.

De Brauw, A. and Giles, J. (2016). Migrant opportunity and the educational attainment of youth in rural china. *Journal of Human Resources*.

Decker, C. S. and Pope, C. R. (2005). Adherence to environmental law: the strategic complementarities of compliance decisions. *The Quarterly Review of Economics and Finance*, 45(4):641–661.

Deily, M. E. and Gray, W. B. (2007). Agency structure and firm culture: OSHA, EPA, and the steel industry. *Journal of Law, Economics, and Organization*, 23(3):685–709.

Dinkelman, T. and Mariotti, M. (2016). The long-run effects of labor migration on human capital formation in communities of origin. *American Economic Journal: Applied Economics*, 8(4):1–35.

DiPasquale, D. and Glaeser, E. L. (1999). Incentives and social capital: are homeowners better citizens? *Journal of Urban Economics*, 45(2):354–384.

Dixit, A. (2004). *Lawlessness and Economics: Alternative Institutions of Governance*. Princeton: Princeton University Press.

Djankov, S., La Porta, R., Lopez-de Silanes, F., and Shleifer, A. (2002). The regulation of entry. *The Quarterly Journal of Economics*, 117(1):1–37.

Duflo, E., Greenstone, M., Pande, R., and Ryan, N. (2014). The value of regulatory discretion: Estimates from environmental inspections in India. Technical report, National Bureau of Economic Research.

Durante, R. (2010). Risk, cooperation and the economic origins of social trust: An empirical investigation. *Manuscript*.

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

Ellison, G. (1994). Cooperation in the prisoner's dilemma with anonymous random matching. *The Review of Economic Studies*, 61(3):567–588.

Evans, J. D. (1996). *Straightforward statistics for the behavioral sciences*. Brooks/Cole.

Evans, M. F. (2016). The clean air act watch list: An enforcement and compliance natural experiment. *Journal of the Association of Environmental and Resource Economists*, 3(3):627–665.

Fafchamps, M. and Lund, S. (2003). Risk-sharing networks in rural philippines. *Journal of Development Economics*, 71(2):261–287.

Farmer, A., Watkins, E., Withana, S., Paquel, K., Iles, A., Oosterhuis, F., Kuik, O., Haines, R., Rayment, M., McNeil, D., Martínez-Granado, M., and Greño, P. (2015). Study to analyse differences in costs of implementing EU policy.

Fehr, E. (2009). On the economics and biology of trust. *Journal of the European Economic Association*, pages 235–266.

Fehr, E., Fischbacher, U., Von Rosenbladt, B., Schupp, J., and Wagner, G. G. (2003). A nation-wide laboratory: examining trust and trustworthiness by integrating behavioral experiments into representative survey.

Fehr, E. and Gächter, S. (2000a). Cooperation and punishment in public goods experiments. *American Economic Review*, 90(4):980–994.

Fehr, E. and Gächter, S. (2000b). Fairness and retaliation: The economics of reciprocity. *The Journal of Economic Perspectives*, 14(3):159–181.

Fehr, E. and Schmidt, K. M. (1999). A theory of fairness, competition, and cooperation. *Quarterly Journal of Economics*, pages 817–868.

Feigenberg, B., Field, E., and Pande, R. (2013). The economic returns to social interaction: Experimental evidence from microfinance. *Review of Economic Studies*, 80(4):1459–1483.

Feng, S., Oppenheimer, M., and Schlenker, W. (2012). Climate change, crop yields, and internal migration in the united states. Technical report, National Bureau of Economic Research.

Fernandez, R. (2007). Culture and economics, New Palgrave Dictionary of Economics, edited by Durlauf, S. and Blume, L.

Fernández, R. and Fogli, A. (2006). Fertility: The role of culture and family experience. *Journal of the European Economic Association*, 4(2-3):552–561.

Fernández, R. and Fogli, A. (2009). Culture: An empirical investigation of beliefs, work, and fertility. *American Economic Journal: Macroeconomics*, 1(1):146–177.

Fischbacher, U., Gächter, S., and Fehr, E. (2001). Are people conditionally cooperative? evidence from a public goods experiment. *Economics Letters*, 71(3):397–404.

Fisman, R. and Miguel, E. (2007). Corruption, norms, and legal enforcement: Evidence from diplomatic parking tickets. *Journal of Political Economy*, 115(6):1020–1048.

Gibson, J., McKenzie, D., and Stillman, S. (2011). The impacts of international migration on remaining household members: omnibus results from a migration lottery program. *Review of Economics and Statistics*, 93(4):1297–1318.

Giuliano, P. (2007). Living arrangements in Western Europe: Does cultural origin matter? *Journal of the European Economic Association*, 5(5):927–952.

Glaeser, E., Laibson, D., and Sacerdote, B. (2002). An economic approach to social capital. *The Economic Journal*, 112:437–F58.

Glaeser, E. L., Laibson, D. I., Scheinkman, J. A., and Soutter, C. L. (2000). Measuring trust. *The Quarterly Journal of Economics*, 115(3):811–846.

Gonzalez-Murphy, L. V. and Koslowski, R. (2011). Understanding Mexico's changing immigration laws. *Woodrow Wilson International Center for Scholars. Mexico Institute, http://www. wilsoncenter. org/sites/default/files/G0NZALEZ*, 20:2526.

Granovetter, M. (1985). Economic action and social structure: The problem of embeddedness. *American Journal of Sociology*, pages 481–510.

Gray, C. L. and Mueller, V. (2012). Natural disasters and population mobility in bangladesh. *Proceedings of the National Academy of Sciences*, 109(16):6000–6005.

Gray, W. B. and Deily, M. E. (1996). Compliance and enforcement: Air pollution regulation in the US steel industry. *Journal of Environmental Economics and Management*, 31(1):96–111.

Gray, W. B. and Shadbegian, R. J. (2005). When and why do plants comply? paper mills in the 1980s. *Law & Policy*, 27(2):238–261.

Gray, W. B. and Shimshack, J. P. (2011). The effectiveness of environmental monitoring and enforcement: A review of the empirical evidence. *Review of Environmental Economics and Policy*, 5(1):3–24.

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

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

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

Guiso, L., Sapienza, P., and Zingales, L. (2015a). Corporate culture, societal culture, and institutions. *The American Economic Review*, 105(5):336–339.

Guiso, L., Sapienza, P., and Zingales, L. (2015b). The value of corporate culture. *Journal of Financial Economics*, 117(1):60–76.

Hardin, R. (2002). *Trust and trustworthiness*. Russell Sage Foundation.

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

Hildebrandt, N., McKenzie, D. J., Esquivel, G., and Schargrodsky, E. (2005). The effects of migration on child health in mexico [with comments]. *Economia*, 6(1):257–289.

Hoff, K., Kshetramade, M., and Fehr, E. (2011). Caste and punishment: the legacy of caste culture in norm enforcement. *The Economic Journal*, 121(556):F449–F475.

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

Jo, A. (2017). Trust, compliance and international regulation. *Mimeo*.

Johnson, N. D. and Mislin, A. A. (2011). Trust games: A meta-analysis. *Journal of Economic Psychology*, 32(5):865–889.

Jordan, J. J., Hoffman, M., Nowak, M. A., and Rand, D. G. (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.

Karlan, D., Mobius, M., Rosenblat, T., and Szeidl, A. (2009). Trust and social collateral. *The Quarterly Journal of Economics*, 124(3):1307–1361.

Kaufmann, D., Kraay, A., and Mastruzzi, M. (2011). The worldwide governance indicators: Methodology and analytical issues. *Hague Journal on the Rule of Law*, 3(2):220–246.

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

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

Lee, J.-W. and Lee, H. (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. *The American Economic Review*, 99(5):2177–2192.

List, J. A. and Sturm, D. M. (2006). How elections matter: Theory and evidence from environmental policy. *The Quarterly Journal of Economics*, 121(4):1249–1281.

Lyon, F. (2000). Trust, networks and norms: the creation of social capital in agricultural economies in ghana. *World Development*, 28(4):663–681.

Maskin, E. and Fudenberg, D. (1986). The folk theorem in repeated games with discounting or with incomplete information. *Econometrica*, 53(3):533–554.

McKenzie, D. and Rapoport, H. (2011). Can migration reduce educational attainment? evidence from mexico. *Journal of Population Economics*, 24(4):1331–1358.

Miguel, E., Gertler, P., and Levine, D. I. (2005). Does social capital promote industrialization? Evidence from a rapid industrializer. *Review of Economics and Statistics*, 87(4):754–762.

Miguel, E. and Gugerty, M. K. (2005). Ethnic diversity, social sanctions, and public goods in Kenya. *Journal of Public Economics*, 89(11):2325–2368.

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

Milinski, M., Semmann, D., Krambeck, H.-J., and Marotzke, J. (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.

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

Munshi, K. (2003). Networks in the modern economy: Mexican migrants in the us labor market. *The Quarterly Journal of Economics*, 118(2):549–599.

Munshi, K. and Rosenzweig, M. (2009). Why is mobility in india so low? social insurance, inequality, and growth. Technical report, National Bureau of Economic Research.

Nachmany, M., Fankhauser, S., Townshend, T., Collins, M., Landesman, T., Matthews, A., Pavese, C., Rietig, K., Schleifer, P., and Setzer, J. (2016). The globe climate legislation study: A review of climate change legislation in 66 countries. *GLOBE International and Grantham Research Institute, London School of Economics*.

Nemet, G. F., Holloway, T., and Meier, P. (2010). Implications of incorporating air-quality co-benefits into climate change policymaking. *Environmental Research Letters*, 5(1):014007.

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

Nyborg, K. and Telle, K. (2006). Firms' compliance to environmental regulation: Is there really a paradox? *Environmental and Resource Economics*, 35(1):1–18.

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

Ostrom, E. (1990). *Governing the Commons: The Evolution of Institutions for Collective Action*. Cambridge University Press.

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

Ostrom, E. (2010). Polycentric systems for coping with collective action and global environmental change. *Global Environmental Change*, 20(4):550–557.

Page, J. and Adams, R. H. (2003). International migration, remittances, and poverty in developing countries.

Portes, A. (1998). Social capital: Its origins and applications in modern sociology. *Annual Review of Sociology*, 24(1):1–24.

Portes, A. and Roberts, B. R. (2005). The free-market city: Latin american urbanization in the years of the neoliberal experiment. *Studies in Comparative International Development*, 40(1):43–82.

Posner, R. A. and Rasmusen, E. B. (1999). Creating and enforcing norms, with special reference to sanctions. *International Review of Law and Economics*, 19(3):369–382.

Poteete, A. R., Janssen, M. A., and Ostrom, E. (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*, pages 223–234. Springer.

Qin, B. and Shogren, J. F. (2015). Social norms, regulation, and environmental risk. *Economics Letters*, 129:22–24.

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

Routledge, B. R. and Von Amsberg, J. (2003). Social capital and growth. *Journal of Monetary Economics*, 50(1):167–193.

Sapienza, P., Toldra-Simats, A., and Zingales, L. (2013). Understanding trust. *The Economic Journal*, 123(573):1313–1332.

Shimshack, J. P. and Ward, M. B. (2005). Regulator reputation, enforcement, and environmental compliance. *Journal of Environmental Economics and Management*, 50(3):519–540.

Shimshack, J. P. and Ward, M. B. (2008). Enforcement and over-compliance. *Journal of Environmental Economics and Management*, 55(1):90–105.

Sjaastad, L. A. (1962). The costs and returns of human migration. *The Journal of Political Economy*, pages 80–93.

Sobel, J. (2002). Can we trust social capital? *Journal of Economic Literature*, pages 139–154.

Stohr, C. et al. (2014). Let's get this right: Swiss GDP and value added by industry from 1851 to 2008. Technical report, Institut d'Economie et Econométrie, Université de Genève.

Strobl, E. and Valfort, M.-A. (2015). The effect of weather-induced internal migration on local labor markets. evidence from uganda. *The World Bank Economic Review*, 29(2):385–412.

Tabellini, G. (2008a). Presidential address institutions and culture. *Journal of the European Economic Association*, 6(2-3):255–294.

Tabellini, G. (2008b). The scope of cooperation: Values and incentives. *The Quarterly Journal of Economics*, 123(3):905–950.

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

Takahashi, S. (2010). Community enforcement when players observe partners' past play. *Journal of Economic Theory*, 145(1):42–62.

Telle, K. (2013). Monitoring and enforcement of environmental regulations: Lessons from a natural field experiment in Norway. *Journal of Public Economics*, 99:24–34.

Theoharides, C. (2017). Manila to malaysia, quezon to qatar: International migration and its effects on origin-country human capital. *Journal of Human Resources*, pages 0216–7714R1.

Udry, C. (1990). Credit markets in northern nigeria: Credit as insurance in a rural economy. *The World Bank Economic Review*, pages 251–269.

Villarreal, A. and Hamilton, E. R. (2012). Rush to the border? market liberalization and urban-and rural-origin internal migration in mexico. *Social Science Research*, 41(5):1275–1291.

Woodruff, C. and Zenteno, R. (2007). Migration networks and microenterprises in mexico. *Journal of Development Economics*, 82(2):509–528.

Yang, D. (2008). International migration, remittances and household investment: Evidence from philippine migrants' exchange rate shocks. *The Economic Journal*, 118(528):591–630.

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