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Culture and Compliance: Evidence from the EU Emissions Trading Scheme

Ara Jo[*]

Abstract

I study the role of culture in firms' compliance decisions in the context of the EU Emissions Trading Scheme, an international regulation implemented in multiple countries with different levels of cultural indicators. To probe causality, I look within countries and exploit the differences in the location of central headquarters of multinational firms. Using trust as a main cultural indicator, this exercise reveals that installations owned by firms headquartered in high-trust countries were more likely to comply with the regulation than those owned by firms headquartered in low-trust countries even when they operate in the same geographic area. Using other relevant indicators of culture such as morality and civic virtue yields similar results, suggesting that culture, measured by several indicators, exerts influence on compliance behavior of firms.

Keywords: Culture, trust, compliance, EU ETS.
JEL Classification: Q54, Z1, K32.

1   Introduction

There exists a growing literature investigating the influence of culture on the design and stringency of regulation (Algan and Cahuc, 2009; Aghion et al., 2010, 2011; Alesina et al., 2015). A related question that has not received as much attention is whether and to what extent cultural traits affect compliance of regulated entities under a given regulation. This question is an empirically challenging one as culture tends to vary mostly at the country level and each country has its own regulation, which makes it difficult to study how compliance with respect to the same regulation may differ across countries due to the differences in culture.

To study this research question, I take advantage of the European Union Emissions Trading Scheme (EU ETS): the world's largest carbon trading market. 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 measured at the country level. Second, the penalty for noncompliance is set at the EU level and its formal enforcement was generally weak across countries (European Court of Auditors, 2015). This feature substantially reduces the problem of having differential levels of severity in punishment for violation. 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 study compliance of firms under environmental regulations 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., 2018; Evans, 2016). I address this lacuna by taking advantage of this unique international dataset that contains over 16,000 installations located across Europe.

To measure cultural traits relevant to compliance, I use generalized trust – the expectation that a random member of society is trustworthy – as a proxy. Previous studies emphasize the role of trust as a fundamental cultural value in a variety of economic outcomes.[1] In particular, a number of papers have shown its effect on the design (Algan and Cahuc, 2009; Aghion et al., 2011) and the stringency (Aghion et al., 2010) of formal regulation. I believe this documented importance of trust with respect

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[1]For example, trust has been shown to affect economic growth (e.g. Tabellini, 2010; Algan and Cahuc, 2010), financial development (Guiso et al., 2004), trade patterns (Guiso et al., 2009), firm structure (Bloom et al., 2012b), and global cooperation (Jo and Carattini, 2018).

to regulation makes trust an appropriate proxy for culture in studying how culture affects compliance, a key operational aspect of formal regulation. Later, I also try additional measures of culture such as morality and civicness in order to explore other cultural traits conceptually relevant to compliance.

I hypothesize that trust has a positive influence on compliance, given the long-held view in sociology that trust shared in a society reflects cooperative norms and civic attitudes (Putnam, 1994; Fukuyama, 1995; Portes, 1998). A growing literature on corporate culture suggests such norms and values are also present at the firm level. Guiso et al. (2015b) observe that firms have clearly defined corporate culture – principles and values that inform the behavior of all the firm's employees.[2]

Another motivation for the hypothesis relates to social motivations such as reputation and fear of social sanctions behind compliance (Cialdini and Goldstein, 2004; Banerjee and Shogren, 2010; Qin and Shogren, 2015). In the context of the EU ETS, the 'name-and-shame' sanction 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. Then, trust may also affect compliance decisions of firms through the high expected compliance rate in society because social sanctions for violators tend to be stronger when overall compliance rate is higher (Cialdini and Goldstein, 2004).[3] Firms in high-trust countries are thus more likely to be cautious about violating the regulation due to their expectation that most of their neighboring firms would be in compliance and the strong expected social punishment from violation.

For identification, the main specification uses the subsample of installations that are owned by multinational firms (MNEs), 40 percent of which are owned by foreign MNEs whose central headquarters are located in a different country from the country where the installations operate. This subsample allows me to include country of operation fixed effects and to exploit the differences in the location of headquarters as the main source of variation, similarly as in Bloom et al. (2012b) where the authors investigate the effect of trust on the degree of decentralization within firms. I then compare compliance decisions of firms that are exposed to the exact same external

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[2]The authors report that when they looked at companies' web pages, 85% of the Standard and Poor's 500 (S&P 500) companies had a section dedicated to corporate culture.

[3]Given the definition of generalized trust in economics literature as the expectation that a random member of society is trustworthy (Guiso et al., 2009, 2015a), it is reasonable to assume that strong trust shared in a society would translate to a high expected rate of compliance by other firms.

environment (e.g. formal enforcement, stringency of other related regulations, etc.) but have different levels of trust coming from the countries of origin.

Consistent with the hypothesis, I find that there is a negative association between noncompliance and trust prevalent in the country where the installation is located. More importantly, 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: 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 1.2 percentage point decrease in the probability of noncompliance. Given the average noncompliance rate of 3.2 percent in the sample, this effect implies a 37 percent treatment effect, which is comparable to the effect of formal enforcement measures (Gray and Shimshack, 2011; Evans, 2016).

Although the main empirical strategy successfully mitigates omitted variable bias at the country of operation level, there might remain omitted variable bias related to institutional factors in the headquarters countries or firm-specific characteristics that are difficult to measure. I attempt to check the extent to which the estimated effect of trust is driven by these remaining factors by including additional controls such as EU ETS-related enforcement practices or general institutional quality in the headquarters countries. The estimated effect of trust appears to be robust to the inclusion of additional controls. This exercise is discussed in detail in Section 4.3.

Once I establish how trust as the main proxy for culture affects compliance, I also try additional measures of culture. The challenge of empirically measuring culture is acknowledged in the literature (Tabellini, 2008; Algan and Cahuc, 2013) and this measurement issue is exacerbated by the existence of many related and overlapping concepts such as morality, moral hazard and civicness that could also explain compliance.[4] Thus, in an attempt to explore other cultural traits conceptually relevant

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[4]The correlation between trust and other cultural traits such as morality and civicness is recognized in the trust literature. For example, see the theoretical and empirical approach taken in Tabellini (2008); Algan and Cahuc (2009); Aghion et al. (2010).

to compliance, I use two additional indicators, namely, non-pecuniary tax morale and civicness. Using these two measures, I find that tax morale prevalent in a country can also predict the compliance decisions of firms headquartered in that country in the EU ETS context even when they operate abroad. The association is weaker when civicness is used, although I observe a strong correlation between civicness and compliance across countries without country fixed effects. I believe this exercise, together with the strong evidence on the effect of trust on compliance, provides support for the argument that culture, measured by several indicators, exerts influence on compliance over and above institutional factors.

The findings from this study provide a micro-empirical foundation for a large number of papers that investigate how culture affects the stringency of regulation in a cross-section of countries, implicitly assuming that individuals and firms are more law-abiding in countries with higher levels of trust and civicness (Algan and Cahuc, 2009; Aghion et al., 2010; Tabellini, 2008; Aghion et al., 2011). For instance, Aghion et al. (2010) find a strong negative association between trust and a variety of regulations in a cross-section of countries and provide a model that shows formal regulation is weaker in high-trust countries due to lower demand for state regulation, assuming individuals behave in a more law-abiding manner in those countries. Similarly, Algan and Cahuc (2009) argue that governments in high-trust countries tend to insure their workers against unemployment through more generous unemployment benefits rather than strong labor protection laws since individuals are less likely to cheat on government benefits. The positive relationship between civic culture and compliance at the micro level presented in this paper adds strong empirical support for these macro-level studies.

This paper also relates to a group of studies that investigate the influence of informal, as opposed to formal, institutions on compliance in different contexts. This paper closely relates to the seminal paper by Fisman and Miguel (2007) in terms of the empirical setting and the findings. They show the importance of cultural norms in home countries on the corruptive behavior (unpaid parking tickets) of individuals who are subject to the same external environment (diplomats stationed in New York City from many different countries). The main finding of this paper that cultural traits of a country can predict the compliance decisions of firms headquartered in that country even when the firms operate abroad is consistent with their findings but arguably concerns the institutionally more important case of a unique international environmental

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regulation. There is also a large literature in public economics documenting the strong presence of non-pecuniary motivations behind individuals' tax compliance (surveyed by Torgler, 2007; Luttmer and Singhal, 2014). Finally, in environmental economics, the effectiveness of informal enforcement measures on compliance is recognized (Ostrom, 1990, 2000), but rigorous empirical evidence is lacking.[5] This paper adds to the literature by providing empirical evidence on the effect of informal institutions such as culture on compliance in environmental regulation.

The article is organized as follows. Section 2 provides background information on the institutional setting and Section 3 describes data used for the analysis. Section 4 presents the empirical analysis and Section 5 concludes.

2 Institutional background

2.1 EU Emissions Trading Scheme

Launched in 2005, the European Union Emissions Trading Scheme (EU ETS) is the world's first and the 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 these countries covering around 45 percent of the EU's greenhouse gas emissions. Its geographic coverage, as large as all of Europe, offers a unique setting for investigating 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.

As the central climate policy in the EU, it is designed to facilitate the reduction of greenhouse gas emissions by at least 80 percent relative to 1990 levels by 2050. The regulation is currently in its third phase (2013-2020) under the EU-wide cap on emissions that is scheduled to decline indefinitely at an annual rate of 1.74 percent.[6] A

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[5]On the other hand, the effect of formal enforcement actions is well-documented. See, for example, 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. (2018); Evans (2016).

[6]In its origin, the EU ETS was proposed as a means for the EU and its member states to meet their obligations under the Kyoto Protocol and the design of the phases reflects this consideration. After the relatively short first phase, the second phase was chosen to overlap with the first Kyoto commitment period (2008-2012). The third phase (2013-2020) bridges the gap between the end of the first Kyoto period and the start of the new global climate agreement (Paris Agreement) in 2020. The fourth phase will run from 2021 to 2030.

number of empirical studies have shown that the EU ETS had robust negative effects on greenhouse gas emissions, while it does not seem to have had strong detrimental effects on economic performance (for a review of the literature, see Martin et al., 2015).

2.2   Formal enforcement

According to the annual compliance cycle, operators of industrial installations and aircraft operators (henceforth called installations) are required to report their emissions of the previous year verified by third-party accredited verifiers by 31 March of each year.[7] Installations should then surrender a quantity of allowances equal to the volume of their verified greenhouse gas emissions of the previous year by 30 April. An installation is considered out of compliance if the number of allowances surrendered by 30 April is lower than its verified emissions. A penalty harmonized at the EU level (40 euros in phase 1 and 100 euros in phase 2 and 3 for each tCO_2 that the installation failed to surrender allowances for) applies to noncompliant installations. The shortfall in compliance is then added to the compliance target of the following year. In other words, paying a fine does not exempt noncompliant installations from their obligations to surrender sufficient allowances.

To have a sense of the strength of formal enforcement, I analyze the annual reports on monitoring and enforcement activities of the regulatory body that each national government is required to submit to the European Commission. From these reports, I find that enforcement was generally weak across countries. For instance, of the countries that submitted a report for 2005 compliance year (four countries did not), only three (Portugal, Spain and the UK) issued penalties on violators although most countries had violators in that year.[8] A policy report prepared by the European Commission (European Court of Auditors, 2015) confirms that most countries are not successful in implementing EU ETS-related penalties. European Court of Auditors (2015) explains that countries are often limited in their own legal and administrative capacity for the successful implementation of EU ETS penalties. Institutions running the regulation are either not empowered to impose sanctions themselves (e.g. Italy) or need to await

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[7]Third-party verifiers are accredited at the national level. However, verifiers who are accredited in one country can work directly in another country without being accredited there. Further, the authorities cannot impose additional conditions on foreign verifiers that are not imposed on domestic verifiers.

[8]The reports were downloaded from European Environmental Agency Reporting Obligation Database in May 2017. Table OA1 in the Online Appendix shows whether there were any penalties imposed on violators in each country in the first phase.

the outcome of lengthy court procedures and appeals (e.g. Germany).[9] The report adds that on-the-spot inspections to assess the implementation of the self-monitoring plan submitted by installations were also very limited.[10] This lack of strong institutional enforcement may explain the existence of noncompliance despite the fact that the cost of purchasing allowances was well below the penalty for not surrendering sufficient allowances throughout the sample period (Figure OA1). It also makes the EU ETS a suitable context to study the influence of culture on compliance, which would be minimal in the presence of perfect monitoring and enforcement.

For other forms of noncompliance such as failing to report changes in the installation's capacity or monitoring plans, each national government is required to lay down their own enforcement rules and penalties (Article 16(1) of the Directive). The presence of these country-specific enforcement rules may also affect the installation's decision to purchase sufficient allowances to cover its verified emissions.[11] In later sections, I propose identification strategies that overcome this obstacle.

3 Data

3.1 Compliance

Data on compliance 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.[12] While providing valuable

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[9]Indeed, the German authority mentions in their 2007 report that penalties for violators in 2005 were issued only in 2007 and a majority of the cases (11 out of 16) are on appeal.

[10]European Court of Auditors (2015) explains that other types of visits to installations were often performed in the context of the Integrated Pollution Prevention and Control (IPPC, Directive 2008/1/EC) or other environmental legislation that were considered to be of higher priority (e.g. in France, Germany and Poland) without specifically addressing EU ETS-related issues.

[11]One might worry about the verification process itself and potential cheating therein. For instance, there is a possibility of under-reporting verified emissions, which leads to over-stated compliance if enforcement on verification is weak or verifiers are corrupt. Thinking about the direction of the bias arising from this, one would expect upward bias, given that this type of cheating would lead to higher observed compliance (or lower noncompliance) and that it is more likely to occur in low-trust countries. This upward bias would lead us to interpret the estimates of the negative effect of trust on noncompliance as conservative upper bounds.

[12]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

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.[13]

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 OA2 in the Online Appendix in detail. 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.[14] Alternative specifications such as considering A and B only or treating C differently yield similar results.

The cross-country compliance rates depicted in Figure 1 reveals startling variation across countries.[15] It is noteworthy that the distribution is highly right-skewed with a majority of countries close to full compliance and several countries with very high

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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. (2018) for India.

[13]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 EU ETS in 2013.

[14]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 plausible that these installations were no longer regulated (or active) and therefore did not have reporting obligations.

[15]The noncompliance rate of a country is calculated as the share of noncompliant installation-year observations between 2005-2015.

noncompliance. Some countries such as Bulgaria, Italy, and Slovakia, have close to or over 10 percent noncompliant installation-year observations. However, the average noncompliance rate across all regulated installations is very low – 3.2 percent – and half the countries show less then 1 percent noncompliant observations during the sample period.[16]

3.2 Measuring culture

To measure cultural traits relevant to compliance, I use generalized trust as a main indicator of culture. The influence of trust as a fundamental cultural value on a variety of economic outcomes is well-documented in the literature (see footnote 1 for references). In particular, given the strong effect of trust on the design (Algan and Cahuc, 2009; Aghion et al., 2011) and the stringency (Aghion et al., 2010) of formal regulation, the use of trust as a proxy for culture seems appropriate in the context of studying how culture affects compliance, a key operational aspect of formal regulation.

I build trust measures from the World Value Survey (WVS) by pooling data from six waves (1984, 1993, 1999, 2004, 2009, and 2014) that covers 19 European countries as well as 33 non-European countries in my sample where global headquarters of the EU ETS-regulated firms are located. The WVS 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 by a binary choice between 0 and 1 where 0 implies "You can't be too careful" and 1 means "Most people can be trusted".[17] The variable that I use in the econometric regression is the average of this answer within each country.

Figure 2 plots the average level of trust by country within Europe. 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 0.15 observed in Romania to a maximum of 0.7 in Norway (15 percent and 70 percent of

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[16]The occurrence of noncompliance was higher in the first phase (over 60% of all noncompliance occuring in the first phase) and fell in the subsequent phases (Figure OA2) in the Online Appendix). This is likely to be because the EU level fine for violation increased by 2.5 times starting from phase 2 (40 euros per tCO_2 in phase 1 to 100 euros per tCO_2 in phase 2 and 3). I include year fixed effects to deal with such year specific factors that affect all regulated firms.

[17]A number of papers have confirmed in experimental settings that survey-based trust measures are indeed correlated with trusting behavior (Fehr et al., 2003; Fehr, 2009; Glaeser et al., 2000; Sapienza et al., 2013).

people saying most people could be trusted in Romania and Norway, respectively). Second, it is readily observable that there are differences across regions of Europe: for instance, Nordic countries (Norway and Sweden) display highest levels of trust in the sample. On the other hand, Eastern European and Mediterranean countries appear to have lower levels of trust. Table OA3 presents the level of trust for a larger group of countries (52 in total) where the global headquarters of regulated firms are located. Later, I also try additional measures of culture such as morality and civicness in order to explore other cultural traits conceptually relevant to compliance.

3.3 Other variables

To control for the quality of formal institutions, I use governance indicators that measure rule of law and regulatory quality at the country level, which have also been used in prior studies that attempt to isolate the effect of trust from that of formal institutions (e.g. Bloom et al., 2012b).[18] In addition, I use information on log gross domestic product (GDP) per capita, percentage of population with tertiary education, and log population from Eurostat. Descriptive statistics for these variables are reported in Table OA4 in the Online Appendix.

Data on firm characteristics comes from Bureau Van Dijk's Orbis Database. I obtain key financial variables that may affect compliance decisions 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 OA5 reports the descriptive statistics of these variables.

4 Empirical analysis

4.1 Trust and compliance

Figure 1 illustrates that there is indeed a negative correlation between trust and non-compliance rates in the EU ETS across countries. To investigate this relationship

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[18]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".

further, I start with micro-level regressions of the following form:

$$Noncomp_{i,t} = \alpha + \beta_1 Trust_{c(i)} + \beta_2 C_{c(i),t} + \beta_3 F_{j(i),t} + \beta_4 I_{k(j(i)),t} + \beta_5 Y_t + \epsilon_{i,t} \qquad (1)$$

where $Noncomp_{i,t}$ is a binary variable that takes 1 if installation i is out of compliance in year t. $Trust_c(i)$ 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.[19] Most empirical analyses in the trust literature follow this approach by taking the average of trust in surveys conducted since the 80's (e.g. Tabellini, 2010; Bloom et al., 2012b).[20] 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. $C_{c(i),t}$ and $F_{j(i),t}$ represent country-level controls and firm-level controls where firms are indexed by j. I further include year dummies Y_t and industry dummies $I_{k(j(i))}$ where industries are indexed by k and based on the main activity type information provided by the EUTL.

I begin by simply regressing the binary noncompliance variable against the trust measure of the country where the installation is located, without any controls (column (1) of Table 1). The coefficient on the trust variable is negative and statistically significant. In the next columns, I include an increasingly extensive set of controls that may affect compliance at the country level and at the firm level. Column (2) includes year and industry fixed effects, column (3) adds country-level controls (log per capita GDP, log population, the share of population with tertiary education, rule of law, and regulatory quality) and column (4) adds firm-level controls (total assets, revenue, employees, the number of installations). The correlation between trust and

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

[20]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.

noncompliance seems to exist independently over and above these factors.

I also try a measure of inhered trust as an instrument to further test the relationship between trust and noncompliance. 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, 2009, 2010; Butler et al., 2016; Jo and Carattini, 2018). 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; 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 less likely to directly affect compliance behavior of firms operating in their source country due to geographical disconnect (i.e., they are born and reside in their adopted countries). Column (5) reports the IV probit estimate, which is negative and statistically significant.[21]

4.2 Exploiting differences in the location of headquarters

The estimates above suggest that there is a negative correlation between trust and noncompliance. However, it is possible that trust might be picking 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). I control for the quality of formal institutions by rule of law and regulatory quality variables, but they may not be perfect.[22]

In the main specification that follows, I look within countries by restricting my sample to installations owned by multinational firms (MNEs) and exploiting the differences in the location of central headquarters. This subsample offers a chance to probe the causality of the relationship between trust and compliance 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

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[21]The first-stage F statistic is 77.

[22]Inherited trust as an instrument (column (5) in Table 1) may not sufficiently address the omitted variable bias in this context. The approach is based on the persistent nature of trust and the main source of omitted variable bias in my context, which is institutional quality, also tends to be persistent over time (Aghion et al., 2010, 2011). Thus, I believe country fixed effect approach that allows me to compare installations operating in the same institutional environment is likely to be more robust than the IV approach.

compliance. I then compare compliance behavior of installations that are exposed to the exact same external environment such as formal enforcement, stringency of other related regulations, but have different levels of trust coming from the country of origin.

There are 10,692 installations in this subsample and 4,310 of them are operated by foreign MNEs whose central headquarters are located in a different country from the country where the installations operate. Summary statistics of firm-level variables for the whole sample and the sample of MNEs is presented in Table A3. Not surprisingly, MNEs tend to operate more installations, be larger in size and have higher revenue and total assets. In terms of compliance, the mean noncompliance rate of installations owned by MNEs is 2.9 percent, lower than the noncompliance rate in the whole sample (3.2 percent) and that of installations owned by non-MNEs (4 percent).[23]

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 and management practices across countries in MNEs. Given this 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.[24] For this purpose, I estimate the equation below:

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[23]I re-estimate the previous specification using this subsample to ensure that the motivating evidence in Table 1 is not sensitive to the composition of the sample. The results are reported in Table OA6.

[24]In a descriptive analysis, I check if there is a shared pattern in compliance behavior across installations owned by the same MNE. To do so, I investigate if the probability of compliance by other installations belonging to the same MNE could predict the installation's probability of compliance. For instance, if there are three installations owned by the same MNE and one of them is out of compliance in a given year, the compliance probability of others would be 1 for the violating installation (because both other installations are in compliance), while the same probability would be 0.5 for the two compliant installations. I find that the compliance probability of other installations belonging to the same MNE is a very strong predictor of the installation's own compliance probability, with a coefficient of 0.89 (P-value < 0.001) in a linear probability model.

$$Noncomp_{i,t} = \alpha + \beta_1 Trust_{h(i)} + \beta_2 CO_c + \beta_3 F_{j(i),t} + \beta_4 I_{k(j(i)),t} + \beta_5 Y_t + \epsilon_{i,t} \quad (2)$$

which is similar to equation (1) except for two main differences. First, the main explanatory variable of interest is now $Trust_{h(i)}$ which measures the average trust in the country of headquarters h, which may or may not be the same as the country of operation c. Second, the specification further includes CO_c, country of operation fixed effects.[25]

The results of this analysis are reported in Table 2. 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 of operation 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 include year and industry fixed effects (column 2) and control for individual firm-level characteristics (column (3)).

Next, I include country of operation fixed effects. The magnitude of the coefficient falls sharply with an extensive set of fixed effects, but the coefficient in column (4) is still negative and statistically significant. This implies that installations 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 institutional environment. One might still worry about time-varying omitted variable bias that confounds the estimate. For instance, after the 2011 nuclear accident in Japan, Germany decided to dramatically reduce their dependence on nuclear power plants while increasing the share of renewable sources in producing electricity. This led to changes in regulatory environment and energy prices that might have affected firms' compliance behavior under the EU ETS. To deal with this concern of time-varying country specific confounders, I include country *by* year fixed effects in column (5). The sample size falls as there are country-year pairs with perfect compliance, thus no variation. However, the coefficient remains qualitatively similar. The findings on the strong influence of trust in the country of headquarters on firms' compliance are

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[25]Firms that have experienced changes in ownership through mergers and acquisitions (M&As) just before or while being subject to the EU ETS (264 firms) are dropped from the sample to reduce the potential measurement error.

in line with the previous studies that document the importance of country of origin characteristics in MNEs' operation abroad (e.g. Bloom et al., 2012a,b).

In column (6), I attempt to compare the effect of trust in the location of operation versus that of trust in the location of headquarters. To do so, I add the trust variable measured in the country of operation to the specification in (3) without fixed effects. I find that the coefficient on the trust in the country of headquarters becomes marginally insignificant, while the coefficient on the local trust measured in the country of operation is negative and statistically significant. Two explanations are possible. First, since 60 percent of the installations are owned by domestic MNEs, there is a large overlap in the variation of the two variables. The local trust variable seems to dominate as the trust in the country of headquarters variable turns on only for installations owned by foreign MNEs that accounts for 40 percent of the sample. Second, without country of operation fixed effects, the endogeneity concern explained at the beginning of the subsection might be reflected in the strong negative estimate of the local trust variable. To check this possibility, I include a region-level local trust variable with country of operation fixed effects in column (7). The coefficient on trust in the region of installation is insignificant, while the effect of trust in the country of headquarters is negative and statistically significant with a similar magnitude as in column (4), consistent with the second explanation.

Not only is the estimated effect of trust on compliance statistically significant, it is also economically meaningful. The marginal effects calculated from the specification in column (4) in Table 2 imply 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 1.2 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).[26] Also, Evans (2016) documents that an information-based

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

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 noncompliance rate of 3.2 percent in my sample, the predicted fall in the probability of noncompliance by 1.2 percentage point caused by the change in ownership from a Filipino firm to a Norwegian firm implies a 37 percent treatment effect.

4.3   Discussions

Although the approach so far deals with omitted variable bias at the country of operation level arguably well, it is still possible that compliance behavior of firms is influenced by enforcement practices or general regulatory quality in the countries where their headquarters are located. Thus, I try to check the extent to which the estimated effect of trust is driven by such institutional factors in the countries of headquarters by adding additional controls. I use the qualitative data from the annual reports on the monitoring and enforcement activities each government submitted to the European Commission in phase 1 (discussed in Section 2.2). From phase 2 (2008 onward), most reports are not open to the public, which makes me restrict the sample to the first phase for this exercise. Using this information, I create a dummy that takes 1 if there were any penalties imposed on installations with excessive emissions (that did not buy enough permits) in the country of headquarters and 0 otherwise. For example, if there were such fines in France but not in Germany in year t, the dummy will take 1 for all French subsidiaries regardless of their country of operation and 0 for all German subsidiaries for that year. This dummy corresponds to enforcement that is narrowly defined to match the dependent variable. I also create an additional dummy that takes 1 if there were penalties for any types of infringements related to EU ETS such as not reporting changes in capacity or not submitting monitoring plans. This dummy reflects more widely defined enforcement activities related to EU ETS. In addition, I use the measures of rule of law and regulatory quality explained in Section 3.3 that have also been used in prior studies to isolate the effect of informal institutions (Bloom et al., 2012b). Finally, I also try an indicator of corruption control to further account

by 10 percentage point, implying a 42 percent treatment effect (with the average violation rate 24 percent in the sample).

for the degree to which corruption prevails in the headquarters countries.[27]

Table 3 reports the results from this exercise. The enforcement variables constructed based on the annual reports do not appear to have any explanatory power (column (1) and (2)). This is not surprising, as discussed in Section 2.2, because enforcement was generally weak in the EU ETS and countries that did impose penalties for violations were not necessarily high-trust countries. In the next columns, I include the measures of the quality of formal institutions as well as corruption control in the countries of headquarters as controls. The additional controls do not show statistical significance, but in column (6) where all additional controls are included, the regulatory quality variable has a negative and statistically significant coefficient. It is noteworthy that the coefficients on trust remain relatively stable and significant when various controls are added.[28] Although this exercise does not rigorously deal with the omitted variable bias coming from the countries of headquarters in the absence of credible instruments, I believe it at least assures us that the estimated effect of trust is not entirely driven by perceived enforcement or general regulatory quality in the countries of headquarters.

I further note that firm-level omitted variable bias might still remain. For instance, Bloom et al. (2012b) show MNEs with headquarters in high-trust countries are larger in size and more decentralized than those with headquarters in low-trust countries. If compliance is correlated with such firm characteristics related to trust in the country of headquarters, this may lead to biased estimates. In the analysis so far, I have directly controlled for firm size to specifically address this concern. However, it is worth keeping in mind that there might be other firm-level omitted factors that are difficult to measure and control for.[29]

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[27]As the other two, this indicator also comes from the World Bank. The precise definition of this indicator is as follows (Kaufmann et al., 2011): "perceptions of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as 'capture' of the state by elites and private interests."

[28]Adding other governance indicators such as government effectiveness, political stability and accountability yields similar results (Table OA7).

[29]For instance, one might worry that firms are subject to different levels of scrutiny from their clients regarding their wrongdoings, which could also influence firms' compliance in their operation abroad and thus be a potential confounding channel.

4.4 Robustness checks

In this section I report the results from a number of robustness checks. Table OA8 in the Online Appendix reports robustness checks for the cross-country analysis using all firms (as in Section 4.1) where I try to (1) drop late joiners in the EU ETS, (2) drop Scandinavian countries with very high levels of trust, (3) use alternative specifications for noncompliance, and (4) use an alternative measure 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 4). Also, I exclude Bulgaria and Romania that joined the EU ETS later, in case there might have been technical difficulties arising from immature infrastructure that affected compliance. Bulgaria and Romania became subject to the regulation in 2007 when they joined the European Union in the same year. Excluding these late joiners does not affect the relationship between trust and compliance (column (2)).

I also try to restrict the sample to MNEs headquartered in Europe since European firms might be more aware of the EU ETS compared with non-European firms and perhaps more sensitive about violating this EU-wide regulation than non-European MNEs. I find a qualitatively similar estimate using this restricted sample (column (3)). Further, I try to drop Scandinavian countries in the sample (Finland, Norway and Sweden) with very high levels of trust in case firms headquartered in these countries are driving the results. The estimate remains robust and qualitatively similar (column (4)).

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 14). Alternatively, I treat these installations as noncompliant when they can be reasonably presumed to be active 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 (5) uses this alternative measure of noncompliance. The coefficient is still negative but turns insignificant, confirming the ambiguous nature of the status C. Next, I try to drop installations

whose verified emissions were corrected later by the competent authority (i.e. those with code D and E) and find a coefficient similar to one from the main specification (column (6)).

Finally, I try an alternative measure of trust to get a sense of potential measurement error in the trust variable. To do so, 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 Guiso et al. (2009), I regress trust on year dummies, form residuals, and then compute the means of these residuals by country. Column (7) shows that the estimated relationship between trust and compliance is not sensitive to this alternative trust measure.

4.5 Additional measures of culture

Throughout the analysis, I have used generalized trust as a main indicator of culture relevant to compliance. However, the challenge of empirically measuring culture is acknowledged in the literature (see, for example, Tabellini, 2008; Algan and Cahuc, 2013) and this measurement issue is exacerbated by the existence of many related and overlapping concepts such as morality, moral hazard and civicness that could also explain compliance.[30] Thus, I explore other conceptually relevant cultural traits by using two additional measures of culture in this section.

First, I use the question in the WVS that has often been used in the tax compliance literature to measure non-pecuniary motivations behind compliance (referred to as tax morale), which reads as follows: "Please tell me for each of the following statements whether you think it can always be justified, never be justified, or can be justified in specific situations: [...] Cheating on taxes if you have a chance."[31] The answer is given on a scale of 1 to 10 with 1 implying "never justified" and 10 implying "always justified." I rescale this variable so that higher values imply higher levels of tax morale. The second additional measure is based on a related question that is answered similarly, "Claiming government benefits to which you are not entitled", which has been used to measure civic attitudes (Algan and Cahuc, 2009). This variable is similarly

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[30]The correlation between trust and other cultural traits such as morality and civicness is recognized in the trust literature. For example, see the theoretical and empirical approach taken in Tabellini (2008); Algan and Cahuc (2009); Aghion et al. (2010).

[31]Tax morale can be considered part of culture to the extend that it reflects internalized beliefs and values that persist over long periods of time. A number of studies have approached tax morale from a cultural perspective by conducting similar laboratory experiments across two or three countries. See Luttmer and Singhal (2014) for a related discussion and references (p.160).

rescaled as the previous one. The two additional variables are highly correlated with each other (significant at 1 percent level). As expected, both measures are also positively correlated with the trust variable across European countries, although neither correlation coefficient is statistically significant (Figure OA3). Table OA9 reports these two additional measures of culture for the larger group of countries where the global headquarters of regulated firms are located.[32]

Column (1) of Table 5 shows a negative correlation between the tax morale variable in the country of operation and noncompliance in the EU ETS (as in Section 4.1), after controlling for various firm and country characteristics as well as year and industry dummies. The estimate from the main specification that exploits the differences in the location of headquarters is reported in column (2). The negative coefficient indicates that even when we compare firms operating in the same geographic area, the strength of non-pecuniary motivations behind tax payment measured in the headquarters countries can predict firms' law-abiding behavior in another context in their operation abroad. To provide an economic sense of the coefficient in column (2), I calculate the marginal effect of a change in ownership from a multinational firm based in the lowest-tax morale country in the sample (Latvia) to another MNE headquartered in the highest-tax morale country (Japan) as in Section 4.2. The hypothetical change would be associated with a 0.9 percentage point decrease in the probability of noncompliance with an implied 28 percent treatment effect. This effect is smaller but comparable to the 37 percent treatment effect implied by a similar ownership change from a firm in the lowest-trust country to another firm in the highest-trust country. Column (3) includes additional controls that measure the enforcement practices and general regulatory environment in the headquarters countries as in Table 3. The coefficient remains qualitatively similar.

Column (4)-(6) repeat the specifications in column (1)-(3) with civicness as an alternative measure of culture. Using civicness as a cultural indicator also reveals a negative association between culture and noncompliance, although the relationship is weaker especially in the more demanding specifications that exploit the differences in civicness measured in the headquarters countries. I believe this exercise, together with the strong evidence on the effect of trust on compliance, provides support for the argument that culture, measured by various indicators, plays an important role in the compliance decisions of firms.

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[32]The country coverage of these questions is very similar to that of the trust question. Only Israel and Saudi Arabia are missing.

5 Conclusion

In this article, I attempt to provide rigorous empirical evidence on the effect of culture on compliance. Using trust as a main indicator of culture, I find strong evidence that trust positively affects compliance and more importantly, there exist systematic differences in firms' compliance patterns depending on the country in which they are headquartered even when they operate in the same geographic area with the same external environment.

One important implication of my findings 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 article provides micro empirical evidence on the role of trust in compliance and by doing so, validates the documented effect of trust on the design of formal regulation through how law-abiding people are (Tabellini, 2008). 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.

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Table 1: Trust and Noncompliance in the EU ETS
between 2005 and 2015

	Dependent variable: Indicator for noncompliance				
	(1)	(2)	(3)	(4)	(5)
Trust	-2.209***	-2.574***	-2.560**	-2.519**	-5.482***
int the country of operation	(0.653)	(0.849)	(1.143)	(1.229)	(1.334)
Observations	104,307	103,654	103,654	66,282	66,282
Firm controls	No	No	No	Yes	Yes
Country controls	No	No	Yes	Yes	Yes
Year dummies	No	Yes	Yes	Yes	Yes
Industry dummies	No	Yes	Yes	Yes	Yes

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 estimations are by Probit except for column (5) where I implement IV probit. The instrument used in column (5) is a measure of inherited trust that instruments trust in each country by the average level of trust held by second-generation immigrants from that country. Standard errors are clustered at the country of operation level.

Table 2: 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)
Trust	-1.596***	-1.770***	-1.763***	-0.390*	-0.460*	-0.527	-0.417**
in the country of HQ	(0.380)	(0.501)	(0.491)	(0.204)	(0.277)	(0.332)	(0.207)
Trust						-1.896**	0.217
in the country of operation						(0.865)	(0.167)
Observations	69,912	69,517	48,896	49,174	33,183	48,896	47,692
Firm controls	No	No	Yes	Yes	Yes	Yes	Yes
Country dummies	No	No	No	Yes	Yes	No	Yes
Year dummies	No	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	No	Yes	Yes	Yes	Yes	Yes	Yes

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 estimations are by Probit. Standard errors are clustered at the country of operation level. Column (1) show a probit estimate without any controls. Column (2) includes year and industry dummies. Column (3) includes firm-level controls (number of installations each firm owns, total assets, operating revenue, and number of employees). Column (4) includes country of operation fixed effects and column (5) includes country by year fixed effects. Column (6) simultaneously includes trust in the country of headquarters and trust in the country of operation without country fixed effects. Column (7) adds a region-level trust measure with country fixed effects.

Table 3: Trust and Noncompliance in the EU ETS in Phase I (2005-2007)

	Dependent variable: Indicator for noncompliance					
	(1)	(2)	(3)	(4)	(5)	(6)
Trust in the country of HQ	-0.957*** (0.260)	-0.949*** (0.265)	-0.989*** (0.332)	-0.716** (0.318)	-1.003*** (0.243)	-0.561** (0.256)
Enforcement, narrow	0.219 (0.348)					
Enforcement, wide		0.147 (0.257)				0.180 (0.399)
Rule of law			0.011 (0.124)			0.674 (0.996)
Regulatory quality				-0.223 (0.231)		-0.993* (0.567)
Corruption control					0.015 (0.084)	-0.129 (0.753)
Observations	12,501	12,501	12,501	12,501	12,501	12,501
Firm controls	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes

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 estimations are by Probit. Standard errors are clustered at the country of operation level. Firm-level controls include the number of installations each firm owns, total assets, operating revenue, and number of employees. Two enforcement measures are constructed based on the annual reports submitted by the competent authority in charge of the EU ETS in each country. Other controls (rule of law, regulatory quality and corruption control) are governance indicators provided by the World Bank.

Table 4: Trust and Noncompliance in the EU ETS between 2005 and 2015:
Robustness Checks

|	(1)	(2)	(3)	(4)	(5)	(6)	(7)
			Dependent variable:				
			Indicator for noncompliance				
Trust	-0.436**	-0.489**	-0.285*	-0.696***	-0.271	-0.384**	-0.402*
in the country of HQ	(0.212)	(0.210)	(0.171)	(0.266)	(0.191)	(0.195)	(0.208)
Observations	46,271	47,584	44,976	38,964	49,218	48,935	49,174
Firm controls	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes	Yes

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 country of operation level. Column (1) includes region-level controls and column (2) drops countries that were included in the regulation later in 2007 (Bulgaria and Romania). Column (3) only uses firms whose central headquarters are located in Europe and column (4) drops Scandinavian MNEs. Column (5) uses an alternative specification for noncompliance that treats installations with missing verified emissions as noncompliant. Column (6) drops installations whose verified emissions were corrected by the competent authority. In column (7), I try an alternative measure of trust that takes into account year-specific shocks.

Table 5: Additional Cultural Measures and Noncompliance in the EU ETS

|	(1)	(2)	(3)	(4)	(5)	(6)
	Dependent variable: Indicator for noncompliance					
Tax morale	-0.623*					
	(0.338)					
Tax morale in the country of HQ		-0.099*	-0.172*			
		(0.054)	(0.096)			
Civicness				-0.264***		
				(0.093)		
Civicness in the country of HQ					-0.007	-0.046
					(0.049)	(0.076)
Enforcement, narrow			0.184			0.176
			(0.390)			(0.404)
Enforcement, wide			0.234			0.218
			(0.398)			(0.393)
Rule of law			0.680			0.656
			(0.990)			(1.076)
Regulatory quality			-1.011*			-1.082**
			(0.539)			(0.550)
Corruption control			-0.151			-0.084
			(0.783)			(0.886)
Observations	66,282	49,108	12,488	66,282	49,108	12,488
Firm controls	Yes	Yes	Yes	Yes	Yes	Yes
Country dummies	No	Yes	Yes	No	Yes	Yes
Year dummies	Yes	Yes	Yes	Yes	Yes	Yes
Industry dummies	Yes	Yes	Yes	Yes	Yes	Yes

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. Column (3) and (6) are estimated on the sample of Phase 1. All estimations are by Probit. Standard errors are clustered at the country of operation level.

Figure 1: Average Noncompliance Rate between 2005 and 2015
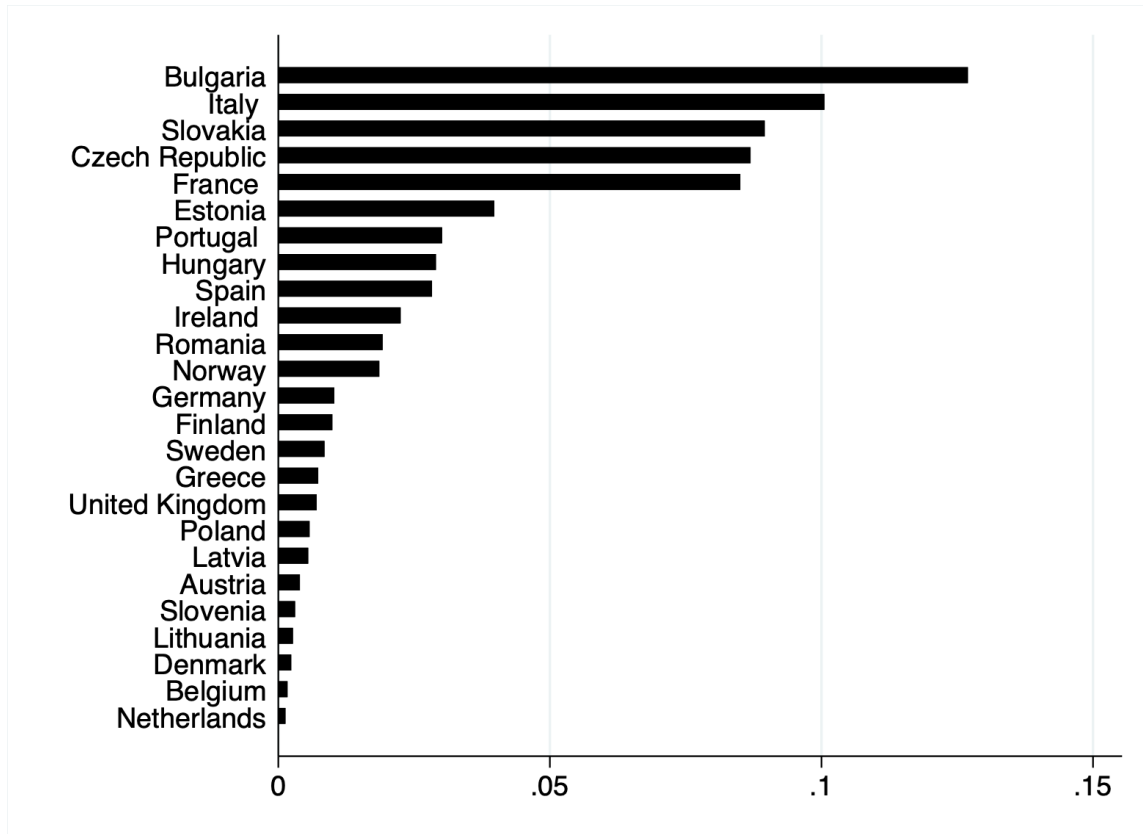
Note: the plot shows variation in noncompliance rates across countries. The data on compliance in the EU ETS is provided by the European Union Transaction Log (EUTL).

Figure 2: Average Trust
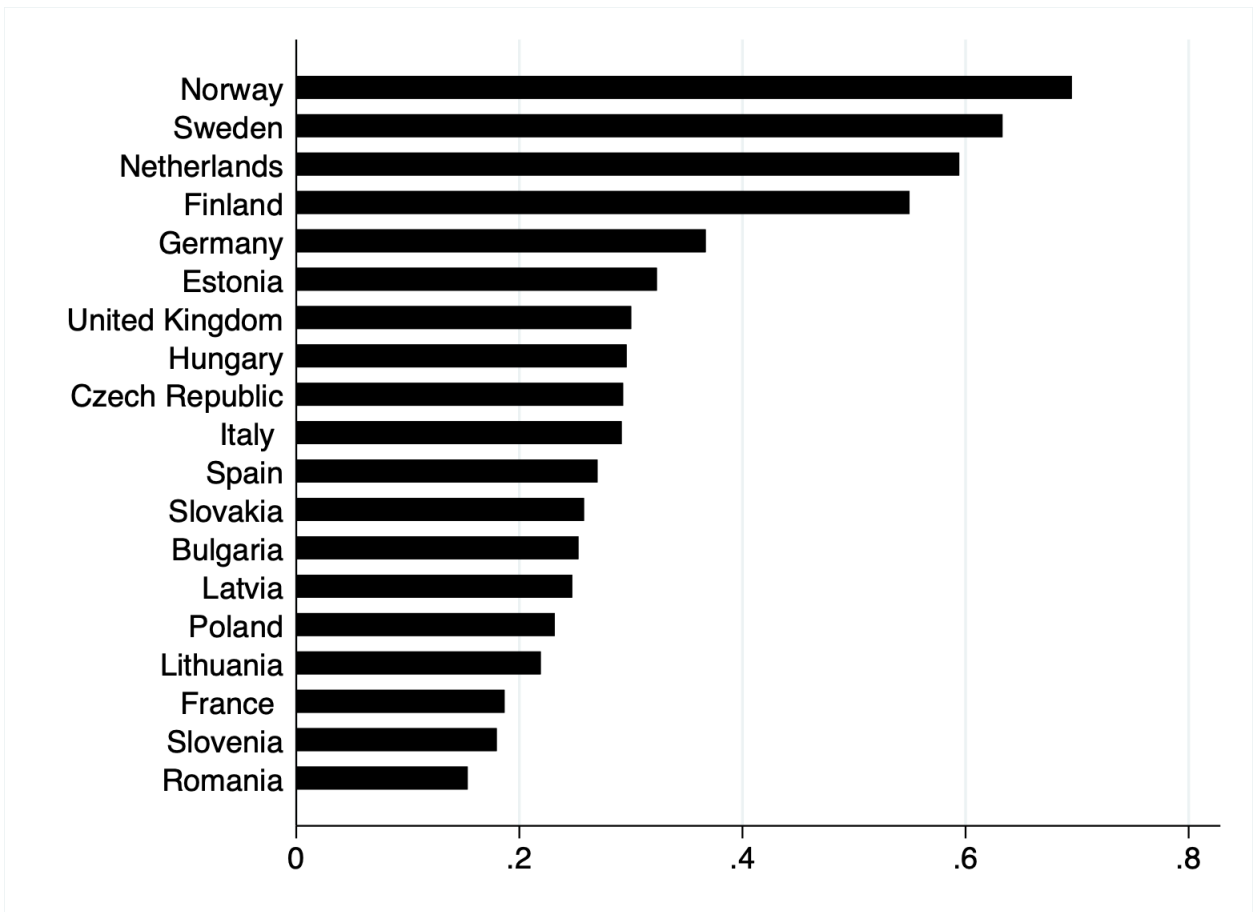
Note: the plot shows variation in the level of average trust across countries. The level of average trust measure is based on the World Value Survey (1984-2014).