Strategic Government Enforcement and Firm Compliance with International Regulation: Evidence from Carbon Regulation*

Patrick Bayer†
University of Glasgow

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Abstract

This article advances a political theory of enforcement and compliance that accounts for two features that are unique to international treaties. First, treaties delegate enforcement decisions to national governments. Second, treaties do mostly regulate firm behavior and not governments themselves. I argue that under these conditions a government enforces penalties strategically only against some types of firms and only some of the time. A government that worries about negative domestic effects from enforcing penalties through, for example, firm relocation or foregone investment, hesitates to enforce international regulation unconditionally. Instead, it only enforces against resilient firms in stable economic times. Testing this prediction against novel compliance data from European carbon regulation, I find that installations from resilient sectors are better compliers, but this difference disappears as markets tumble. During an economic crisis, structural dependence on capital increases, and governments shield even resilient firms from strict penalty enforcement.

Keywords: enforcement; compliance; international treaties; government-firm interaction; carbon regulation; formal model.

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†School of Social and Political Sciences. University of Glasgow. Adam Smith Building, 40 Bute Gardens, Glasgow, G12 8RT, Scotland, UK. Email: patrick.bayer@glasgow.ac.uk

1 Introduction

For international treaties to be effective, governments need to comply with them. Compliance alone does however not necessarily guarantee good cooperation outcomes because governments are strategic as to which treaties they join and how they design them (Downs, Rocke, and Barsoom, 1996; Koremenos, Lipson, and Snidal, 2001). Selection and endogeneity problems trouble our inferences about whether treaties only screen compliant types or can indeed constrain behavior (von Stein, 2005; Simmons and Hopkins, 2005; Lupu, 2013). Scholars have been emphasizing reciprocity and reputation (Keohane, 1984; Simmons, 2000; Morrow, 2007), credible commitments (Smith, 1998; Martin, 2000), domestic audiences (Dai, 2005; Chaudoin, 2014*a*; von Stein, 2016) as well as norms (Chayes and Chayes, 1993) as mechanisms that affect compliance with international treaties.

Interestingly, most of the existing literature focuses on *governmental* compliance. However, international regulation does in fact often regulate firms and not governments: the International Convention for the Prevention of Pollution from Ships (MARPOL) regulates oil discharge from tankers (Mitchell, 1994), Basel regulations set capital standards for banks (Wilf, 2016), and the Minimum Age Convention prohibits firms to use child labor in manufacturing (von Stein, 2016). Firm behavior therefore clearly shapes national compliance, yet we know little, both theoretically and empirically, about the political economy of firm regulation from international treaties.

This article advances a theory that accounts for the strategic interaction between a government and a firm in the presence of a regulation from an international treaty. Relative to standard models, where governments impose regulation to correct mostly *domestic* market failures (Viscusi, Vernon, and Harrington, 2000; Baldwin, Cave, and Lodge, 2011), government incentives to enforce *international* regulation are likely weaker. Treaty policy results from compromise and typically reflects government interests less well than purely domestic regulation would.[1] Governments may

[1] This is not to say that national regulation would perfectly reflect government preferences, but only that preference heterogeneity across two (or more) countries is likely higher than between government and domestic opposition

therefore be hesitant to enforce regulation from international treaties at all cost, and treaty violation remains an option (Simmons, 2010, 286). Just recently, European steelmakers, including steel giants Tata, ArcelorMittal, and ThyssenKrupp, have been reaffirming worries over "high energy costs and onerous green levies" from EU-wide environmental regulation, allegedly putting 320,000 jobs on the line.[2] High domestic regulatory costs from, for instance, firm closures or relocation of production sites challenge governmental compliance with treaties (Bernhagen, 2008).

Enforcing treaty regulations against firms is however complicated by the fact that firms differ in how useful they are for political survival. Some businesses confer more benefits than others (Przeworski and Wallerstein, 1988), and so governments will be strategic about enforcement: they will select some *types* of firms against which to enforce compliance (i.e., the ones for which regulation reduces the flow of firm benefits to governments the least), which I shall call *resilient*, while not enforcing international regulation against others.

A formal model of government-firm interaction strengthens this intuition and allows to derive two testable implications. First, firms which are likely targets of strict enforcement have strong incentives to comply with international treaty regulation. Second, as a government's (prior) belief about how badly regulation affects firms worsens, as for example in times of economic crisis, non-compliance should peak particularly among previously compliant firms. The logic here is straightforward: while a government would typically enforce regulation against these resilient firms when the economy performs well, it gives these firms more slack under economically bad conditions. With profits already squeezed, imposing additional regulatory costs on firms threatens to significantly decrease the flow of benefits a government can reap from a firm's presence (e.g., tax, employment, or investment benefits). In equilibrium, a firm anticipates this more protective behavior and cuts back on compliance.

within any single country.

[2] "Steel industry at 'breaking point' as it calls for Europe-wide help." *The Telegraph*, 17 October 2016. See https://www.telegraph.co.uk/business/2016/10/17/steel-industry-at-breaking-point-as-it-calls-for-europe-wide-hel/. Accessed 31 March 2017.

Drawing on installation-level compliance records in European carbon markets, I test both hypotheses against original data from the first eight years (2005-2012) of the largest regulatory policy worldwide to cut back carbon emissions (World Bank, 2017). Importantly, carbon markets—officially, the European Union Emissions Trading System (EU ETS)—fit my argument's scope conditions well. First, the EU ETS was implemented to meet member states' reduction targets under the Kyoto Protocol on Climate Change and hence operates in the shadow of an international treaty. This makes it distinct from purely domestic regulation to which most standard theories of regulation apply. Second, despite EU-wide implementation, for the period under study, compliance and enforcement rests with national governments (instead of supranational EU institutions), which makes my government-firm argument useful. The empirical results offer support for the two central model predictions. Installations in resilient sectors are more likely to be better compliers than those in less resilient sectors, but this difference in compliance behavior shrinks as the economy slows down—even when controlling for systematic differences across EU member states and installation characteristics.

This study makes several broader contributions. First, it extends a growing literature on the interaction of governments and firms beyond trade politics (Osgood et al., 2017; Baccini, Pinto, and Weymouth, 2017). Further, by advancing a novel argument about a government's (dis)incentive to enforce regulation from international treaties against firms, I propose a regulatory mechanism that links a country's domestic political economy and international treaty compliance. In that, my model offers a microfoundation from regulatory politics as to why governments seek flexibility in international treaties under conditions of (economic) uncertainty (Rosendorff and Milner, 2001; Koremenos, 2005). Finally, the paper reminds us that governmental compliance is usually the sum of many compliance decisions by other actors, such as firms. Unmasking this variation likely allows for more compelling empirical testing and helps build more nuanced theories of compliance and international cooperation more generally.

2 Firm Compliance with International Regulation

Most scholars propose that regulation is to protect the general public from negative consequences of market failures (Baldwin, Cave, and Lodge, 2011), yet Stigler (1971) suggests regulation can also be used to control market access.[3] In standard setups, a government/regulator monitors firms, and firms comply with regulation as long as compliance costs are lower than expected penalties (Winter and May, 2001). Generalizing this framework to account for the possibility of governments regulating other governments or public agencies, Konisky and Teodoro (2016) advance a political theory of regulation in which the regulator is strategic about whether to enforce violations:[4] penalizing other governments is more costly than penalizing private firms, not least because agencies litigate more successfully, and so enforcement against agencies, relative to private firms, is less likely. Similarly, Gordon and Hafer (2005, 245) show that firms can use their political contributions to signal their willingness to fight the bureaucracy over regulation, making enforcement strategic in that "regulators will simply choose either to regulate less or to regulate elsewhere." My model below shares this feature of strategic enforcement, but derives differences in enforcement costs from a firm's resilience to penalty payments—instead of political contributions or whether it is a public agency or private firm. My model further embeds strategic enforcement within the context of international instead of domestic regulation. This extends my argument, in contrast to most other works, beyond a strictly national focus.

Focusing on national regulation, the "race to the bottom" argument theorizes about regulatory effects on national production in a globalized world economy. It essentially puts forward the simple idea of international, downward competition over domestic regulation in order to attract investment or prevent capital flight.[5] Government competition over offering "more favorable"

[3] The self-regulation literature emphasizes the strategic role of voluntary regulation to preempt government regulation and control market access. See Khanna (2001) for a review.

[4] König and Mäder (2014) also find evidence of strategic enforcement by the European Commission as the central monitoring agency in the European Union.

[5] Obviously, firms' investment decisions are multidimensional, and regulatory cost may pale compared to labor cost or market access. This may even lead to ratcheting up (Vogel, 1995) or the voluntary adoption of regulatory standards

regulation typically comes in two flavors: either *adopting* less stringent new regulation or *not enforcing* existing rules (Konisky, 2007; Cao and Prakash, 2010). In my setup, however, where regulation results from an international treaty and not from domestic policy (as in the standard race to the bottom formulation), governments have no incentives to adopt new regulation as this would require costly treaty (re-)negotiation; instead, it is easier to fend off threats of firm relocation by strategically reducing enforcement efforts (Cao and Prakash, 2012). As a critical feature in models of international regulation, competitive pressures can be powerful enough to push a government "toward treaty violation" (Simmons, 2010, 265)—and the more so, the more a government is structurally dependent on firm benefits (Lindblom, 1977; Przeworski and Wallerstein, 1988).

Other works tackle international (instead of domestic) regulation more head-on. In international environmental governance, effective organization, structural power, and private information shape government-business interaction in treaty participation and compliance (Bernhagen, 2008). Firm compliance with treaty regulation is hence elusive if non-compliance is not easily observable by regulators (Mitchell, 1994). More recently, Ovodenko (2017) argues that industrial concentration is key for understanding global environmental regulation. Oligopolistic industries are best positioned to comply with international regulation as they have more resources and better technologies than producers in more fragmented markets.

Importantly, these arguments conceptualize the relationship between governments and firms at the sectoral or industry level. While this offers valuable insights, it also blackboxes firm-level variation within any given sector. Compliance is ultimately a decision each firm needs to make individually, and the same goes for government enforcement. Firm characteristics are more important than sectoral attributes (Gray and Shimshack, 2011). My formal model therefore operates at the firm-level. A government is hesitant to enforce penalties against those least resilient *firms* for which it expects the largest "political fallout." In that, my theoretical argument's emphasis on firms mimics recent advances in the trade politics literature (Osgood, 2017).

(Prakash and Potoski, 2006).

3 A Theory of Strategic Enforcement of International Regulation

This section develops a theory of strategic government enforcement and firm compliance with international regulation. In the formal model, the government decides whether to enforce a non-compliance penalty against a firm which violates regulation from an international treaty. Neither the type of regulation (e.g., command-and-control or market-based instruments) nor the issue area (e.g., trade, environmental, or financial regulation) affect my argument, but the model rests on two informational assumption.

First, the government can perfectly observe firm compliance. It hence knows with certainty whether a firm complies or violates regulation. Analytically, this is a useful assumption as it isolates the effect of strategic enforcement. If a government chooses not to enforce a non-compliance penalty, this is a strategic choice that is not driven by the non-observability of firm behavior or prohibitive search costs. The assumption is further compatible with the literature which argues that at least for some enforcement problems, in which international organizations, transnational NGOs, or domestic watchdogs provide compliance information, governments can monitor firm behavior fairly well even if they do not do so themselves (Raustiala, 1997; Abbott and Snidal, 2010). For regulation from international treaties, this mechanism should be particularly strong. In my empirical test below, the European Commission centrally records data on compliance with carbon regulation and shares this information with governments.[6]

Second, I assume that firms have private information about how severely they are affected by non-compliance penalties (Austen-Smith, 1993). It is rational for businesses to overstate impacts, and they are usually quick to evoke layoff and relocation threats. Governments are at an informational disadvantage because assessing the real cost implications from regulatory policy is almost impossible (Bernhagen, 2008, 85).

[6] Notably, even relaxing this assumption would not change the model's basic insight as long as the government receives a (minimally) informative signal about firm behavior.

3.1 Actors, Payoffs, and Sequence of Moves

Government-firm interaction in the context of regulation from international treaties, such as international banking, labor, or environmental regulation, can be formalized as a sequential game. A firm first decides whether to comply with the regulation, $C = \{0, 1\}$; given this choice, the government moves second and decides whether to enforce a penalty or not, $E = \{0, 1\}$.

In a departure from conventional models of regulatory politics in which governments need to invest effort to find out about firm compliance (e.g., Baldwin, Cave, and Lodge, 2011), uncertainty in my model does not lie with hidden firm action. As discussed above, the government knows (free of charge) whether a given firm complies or not. What it does however not know is how non-compliance penalties affect firm operations. The government is thus uncertain about the likelihood that it can extract benefits from the firm. This creates an obvious trade-off: the government values compliance but it also fears that imposing penalties reduces (possibly to zero) the amount of benefits it can derive from businesses. All too often, firms threaten to relocate or let employees go to fend off regulation, so a similar trade-off, I argue, is at play when it comes to enforcing non-compliance penalties.

Governments are structurally dependent on firms (Lindblom, 1977; Przeworski and Wallerstein, 1988) as businesses produce benefits that secure political survival. Higher tax income allows funding public goods; employment, investment, and innovation all generate economic growth, and a well performing economy wins elections. However, for these benefits to materialize, firms have to make profits. Profits have repeatedly been shown to correlate with other firm characteristics, such as exporter status, productivity, job creation, and higher wages (Bernard and Jensen, 1999; Bernard et al., 2007; Eaton, Kortum, and Kramarz, 2004; Helpman, Melitz, and Yeaple, 2004; Melitz, 2003), that a government might value, even independent of firm profits *per se*. Notwithstanding that not every single profitable firm pays taxes, invests heavily in new technology, or creates jobs, more profitable firms should on average create more benefits for a government rela-

tive to less profitable ones. The crux for a government then is that enforcing penalties takes away cash from firms and might lower government benefits from firms operations. Therefore, strict enforcement of non-compliance is not always in the government's best interest.

To fix ideas, government utility in my model depends on firm profits. Other factors can matter too, but as long as higher profits translate into higher government utility, focusing on firm profits is a reasonable choice. Importantly, equilibrium results do not depend on it as long as government utility (i) increases in this variable, but (ii) decreases in it when penalty payments are made. Whether this variable captures firm profits, employment, R&D investments, or even a firm's brand value is immaterial to the model, yet firm profits facilitate an easy and direct interpretation.

A firm's decision to comply or not depends on how compliance payoffs compare to non-compliance payoffs.[7] Let π denote the profits of a non-compliant firm, which avoids paying compliance cost $c > 0$. Complying with labor standards, environmental protection, or financial regulation is typically costly, as is compliance with international environmental treaties, because treaties "require firms to reduce emissions, increase recycling, pay more for energy" (Bernhagen, 2008, 83). Firms can always comply, but compliance might not be cheap. Reduced form compliance payoffs are

$$\Pi^c = \pi - c.$$

A firm can also remain non-compliant, which becomes increasingly attractive as compliance costs rise. Non-compliance saves money the firm would otherwise have to spend on compliance measures. At the same time, it is a risky choice as non-compliance may be fined and penalties could be steep. As long as penalty payments $r > 0$ are higher than compliance cost c, compliance is more

[7] Payoff functions in the model are kept as simple as possible. Note however that the envelope theorem ensures that payoff functions of the more complex type $\Pi(x;q) = \pi(x) - c(x;q)$, with x a choice variable (level of non-compliance) and q a (cost) parameter, produce the same preference ordering if: (i) the cost parameter for compliance is smaller than for penalty enforcement; and (ii) $\frac{\partial c(x;q)}{\partial q}$ is positive, so that the value function is decreasing in q. Under these conditions, more complex functional forms are guaranteed to reproduce the same preference ordering over outcomes.

desirable. However, this is only true if penalties are indeed enforced. Non-compliance payoffs must therefore depend on whether a government enforces ($E = 1$) penalties or not ($E = 0$):

$$\Pi^n = \begin{cases} \Pi^n_{|E=1} = \pi - r & \text{if } E = 1 \\ \Pi^n_{|E=0} = \pi & \text{if } E = 0 \end{cases}$$

Payoffs in this game induce a unique preference ordering. A firm prefers unenforced non-compliance to compliance, and compliance to enforced non-compliance, so $\Pi^n_{|E=0} \succ \Pi^c \succ \Pi^n_{|E=1}$ holds for $r > c$.[8] Compliance is the safe option here, but a firm may gamble on non-compliance if it believes the government is unlikely to enforce penalties; however, should the government (unexpectedly for the firm) enforce penalties, the firm's worst outcome obtains.

What then determines whether a government enforces penalties or not? If it decides to look the other way, it receives a non-enforcement payoff V^n. This payoff is given as the sum of a government's firm valuation v^n and some non-enforcement cost $d > 0$. Governments value firms as firms generate obvious benefits for governments: they pay taxes, generate employment, and make capital investments, all of which stimulate growth and translate into electoral success for the government (Besley, 2006). Building on the long standing notion that governments are structurally dependent on firm capital (Przeworski and Wallerstein, 1988), a government in my model values the firm for its contribution to the national economy. As this contribution is higher for more profitable firms, the government's valuation

$$v^n = v(\pi)$$

is increasing in profits π, where v is an increasing and concave function. Importantly, model results below carry through even if the government did not value profits π *per se*, but any increasing function thereof. If the government worries about, say, tax revenues (instead of profits directly),

[8] The model produces qualitatively identical results for any arbitrarily complicated objective function as long as the firm's preference ordering—shared with 'market entry' games—over outcomes is preserved.

it indirectly worries about firm profits, too, as long as higher profits imply higher taxes.[9] For my argument to hold, why exactly a government therefore values a firm is less important than that the government values a firm for its contributions to the national economy.

Despite benefits from firm valuation v^n there are also costs from non-enforcement, d. In the shadow of an international treaty, governments may suffer reputation costs and lose credibility both internationally and domestically (Fearon, 1994; Smith, 1998). To what extent these costs matter depends on the context. Not enforcing treaty commitments against firms committing flagrant human rights violation or defying child labor protection laws is surely costly, while this might not be true for more technical regulation. Kono (2006) shows that complex non-tariff trade barriers slip voter scrutiny. Yet, even if voters knew about non-compliance, fear over loss in jobs and industrial competitiveness may mute voices favoring strict enforcement. Preferences over policy contents and distributional effects can override voters' concerns about leaders not living up to their promises (Snyder and Borghard, 2011; Chaudoin, 2014*b*).

Non-enforcement payoffs in my model are

$$V^n = v^n - d = v(\pi) - d,$$

which gets at the government's trade-off of weighing benefits from high firm valuations when firms run their operations unobstructedly and make higher profits (because of non-enforced penalties) against political, non-enforcement costs. Non-enforcement is thus most likely when d is low, such as for technical regulation flying under the radar of public oversight or when distributional effects make enforcement costly for electorally relevant audiences (Dai, 2005).

Alternatively, the government can enforce penalties. This affects government utility in two ways. First, it decreases the government's firm valuation. Second, it introduces asymmetric information and consequently makes government utility probabilistic.

[9] Formally, define tax revenues as a function of profits, so that $t = t(\pi)$. The government's valuation then becomes $v^n = v(t(\pi))$, which produces qualitatively similar results as long as t is an increasing function.

If the government enforces penalties, it receives a penalty payment $r > 0$ from fining the firm. However, as penalties are a drain on a firm's pockets, profits decrease, and with them, a government's valuation decreases as well. The valuation of a firm under enforcement v^e is (at least weakly) smaller than under non-enforcement, so that

$$v^e = v(\pi - r) \leq v^n = v(\pi)$$

holds. This does not mean that a government does no longer value a firm when penalties are enforced, but simply that these benefits are likely smaller than under non-enforcement. In a situation in which penalties would eat up a firm's profits almost entirely, this firm would be much less likely to expand its business or invest in R&D relative to when it had no penalty payouts. Penalty enforcement hence drives down firm profits, but through structural dependence, a government's evaluation of the firm as well.

The second effect of enforcing penalties is that it introduces asymmetric information into the model as the government cannot know how hard penalty enforcement hits the firm. This is private information. A firm can therefore always threaten to, for example, relocate or lay off employees, should penalties be enforced, and there is no way for the government to assess *ex ante* how credible these threats are. The government cares about these threats as they reduce the valuation of the firm, v^e, possibly to zero, if they are followed through.

Despite asymmetric information, the government knows that threats need to be incentive compatible: a firm would indeed only relocate or lay off employees if penalties are large enough to drive down firm profits below an "outside" payoff $\bar{\pi}$, which we can simply think of as a minimum profit level a firm requires for not letting workers go or not relocating. Even though $\bar{\pi}$ is *internal* to the firm and thus private information, a government can nonetheless form an expectation over whether a firm lives up to its threat. Defining *net profits* as a random variable $\theta \equiv \pi - \bar{\pi}$ that follows a cumulative distribution function F, with $\theta \sim F$, the government evaluates the probability

for $\pi - r > \bar{\pi}$ to hold with $Pr[\theta > r] = 1 - F(r)$.

This probability denotes the likelihood that a firm is *resilient* to penalty enforcement, and therefore has profits π, net of penalties r, that are larger than the internal profit threshold $\bar{\pi}$. The government would like to know about firm resilience as it only receives benefits v^e for this type of firm. The government's enforcement payoff

$$V^e = [1 - F(r)]v^e + r$$

captures this uncertainty about firm resilience by making valuation benefits v^e a probabilistic function of a firm's net profits θ.[10] In contrast, non-enforcement payoffs are a secure payoff which serves as a guaranteed reservation utility the government obtains when it enforces penalties.

3.2 Equilibrium Characterization

This is a sequential game of perfect and incomplete information. The government can observe firm behavior, but is uncertain about the firm's type, that is, its net profits θ. For this class of games, the appropriate solution concept is the perfect Bayesian equilibrium (Fudenberg and Tirole, 1991, 325). Such an equilibrium requires firm and government strategies to be mutual best responses. A firm strategy maps firm types θ into compliance action $C = \{0, 1\}$, and a government strategy maps the observed firm action into an enforcement decision $E = \{0, 1\}$; along the equilibrium path, the government updates beliefs about firm profits consistent with Bayes rule.

In equilibrium, the government enforces regulation only if the enforcement payoff V^e is larger than what it gets from non-enforcement V^n.[11] Enforcement payoffs depend critically on the prob-

[10] Notably, this uncertainty persists even if the government knew firm profits π with certainty from a firm's financial reporting or its tax records. What drives the model is uncertainty about $\bar{\pi}$.

[11] In the appendix, I show that the regularity condition $d + r \leq v^n \leq v^e + d + r$ needs to hold for $\hat{\sigma}$ to be bounded on $[0, 1]$. The first inequality ensures that a government's valuation of the firm under non-enforcement, v^n, is large enough to make non-enforcement incentive compatible (otherwise, the government would always enforce penalties); the second inequality ensures that a government's valuation of the firm under enforcement, v^e, is (still) large enough to make enforcement incentive compatible (otherwise, the government would never enforce penalties). I assume that this condition holds as it produces variation in equilibrium behavior, which is the analytical objective of the model.

ability that firm's net profits are high enough, that is, on the government's belief that a firm is resilient to penalty payments. Denoting the posterior probability distribution with $\tilde{F}_\theta$ and defining the government's posterior belief about firm resilience as $\tilde{\sigma} \equiv 1 - \tilde{F}_\theta(r)$, the government's best response is

$$E = \begin{cases} 1 & \text{if } \tilde{\sigma} > \hat{\sigma} \\ 0 & \text{if } \tilde{\sigma} \leq \hat{\sigma}, \quad \text{where } \hat{\sigma} \equiv \frac{v^n - r - d}{v^e}. \end{cases}$$

A government enforces non-compliance penalties if the posterior belief for a resilient firm is sufficiently high ($\tilde{\sigma} > \hat{\sigma}$). Observing non-compliance and updating prior beliefs about firm's net profits, the government finds enforcement only rational if chances are large enough that penalty payments do not run a firm into the red. On the other hand, when non-compliance fines are likely higher than net firm profits, the government is better off to grant the firm some slack and abstain from strict enforcement. This is the case when the posterior belief about firm resilience is low ($\tilde{\sigma} \leq \hat{\sigma}$).

The government makes inferences about a firm's resilience based on the firm action and the prior distribution $\theta \sim F$, which is common knowledge. Clearly, the firm knows its own type. In making an optimal decision, the firm however needs to anticipate which information (about its type) it signals to the government by being non-compliant. Non-compliance is only attractive if the government understands it as a signal that a firm has low net profits, triggering the government to avoid strict enforcement. If, despite the signal, the government were still to enforce, compliance is the better choice for the firm. Whether the government chooses one action over the other depends on what information it holds about a firm's resilience. Specifically, the government considers how likely non-compliance is for each possible level of net profits (i.e., firm type) and calculates the posterior probability for a firm to be resilient. A firm's best response is thus a mapping from the continuous type space θ into a compliance action, $C = \{0, 1\}$.

For completeness, I derive the (trivial) equilibrium results when the condition is violated in the appendix A1 as well.

As is standard with perfect Bayesian equilibrium solutions, I distinguish between pooling equilibria, in which all types behave in the same way, and "separating" equilibria, in which some types behave differently from others.[12] In the context of this game, pooling occurs when a firm chooses the same action no matter what its net profits are. Separation happens when, for example, a firm complies for net profits above a certain cutoff, but does not comply for net profits below it. Appendix A1 proves that two pooling and one separating equilibria exist in this game.

Proposition 1 (Pooling equilibria). *Define a the government's prior belief about firm resilience as* $\sigma \equiv 1 - F_\theta(r)$ *with* $\theta \sim F$ *and let* $c < r$*, then two pooling equilibria exist:*

(i) For a sufficiently pessimistic prior with $\sigma \leq \hat{\sigma}$*, all types are non-compliant and the government never enforces.*

(ii) For a sufficiently optimistic prior with $\sigma > \hat{\sigma}$*, all types comply.*

The first pooling equilibrium characterizes a world in which the firm never complies with international regulation; the government also never enforces penalties. Such an equilibrium can only be sustained if the government believes that firm types are not resilient enough to withstand enforcement penalties. The prior belief for net profits θ must be so low that the government plays safe and does not risk enforcement.

In the second pooling equilibrium, a firm always complies as the government's prior belief is so optimistic that it would always enforce the non-compliance penalty should the firm violate the regulation. Here, the government is confident that firm's net profits are high enough. Firms are resilient and would continue to produce benefits for the government despite the penalty payout.

Now, let's turn to the class of separating equilibria, one of which exists in the game.

Proposition 2 (Information transmission equilibrium). *For a sufficiently optimistic prior about firm resilience with* $\sigma > \hat{\sigma}$ *and* $c < r$*, a separating equilibrium exists, in which types can truthfully*

[12] With a continuous type space, what I refer to below as separating equilibria are semi-separating equilibria in a strict sense as not every single type takes a different action.

transmit their type information:

(i) Low types with $\theta \leq \hat{\theta}$ do not comply, and the government does not enforce.

(ii) High types with $\theta > \hat{\theta}$ do always comply.

In this separating equilibrium, the firm differentiates its actions and signals valuable type information to the government. This signaling works as it is costly, and the firm therefore limits non-compliance to when net profits are indeed low. The government can hence be sure that whenever it sees a non-compliant firm, this is not a high type trying to shirk regulation. Instead, non-compliance signals that a firm is not resilient enough with net profits θ falling below the cutoff $\hat{\theta}$, which is exactly identical to r. The government's best response in this instance is not to enforce penalties.

However, given governmental non-enforcement, how can high types credibly commit not to defect? Payoffs from unenforced non-compliance are the highest ones in the game and make this deviation possibly attractive for even a resilient firm. However, once a high type with $\theta > \hat{\theta}$ begins to misrepresent its type, we return to a pooling equilibrium, where firm types above and below the cutoff $\hat{\theta}$ do not comply. In this scenario, no type information could be signaled to the government. Yet, for a sufficiently optimistic prior belief, the government reverts to enforce penalties against all types. This would leave both, low and high types worse off than under the separating cutoff strategy. The optimistic prior belief about firm resilience hence effectively deters defection and enables firms to credibly signal type information.

Signaling type information is also important for equilibrium selection. The separating and second (full compliance) pooling equilibrium can both be sustained for sufficiently optimistic prior beliefs $\sigma > \hat{\sigma}$. The separating equilibrium is however informationally more efficient. Here, the government tailors its enforcement behavior to firm type, which avoids enforcing penalties against the non-resilient firm. This equilibrium is less wasteful in incentives and both the government and firm prefer separation to pooling. In appendix A2 I show that the separating equilibrium (weakly)

Pareto-dominates the pooling equilibrium, so that I assume that separation is played for optimistic priors.

3.3 Testable Implications

The main take-away message of the model is that the government's prior belief about firm resilience is critical for the enforcement decision. Strictly enforcing regulation reduces firm profits and may result in undesirable consequences for governments that are structurally dependent on firm success. Slow growth, soaring unemployment, loss in market share, or business relocation destabilize a country's economy and a leader's political support. These effects are even more pressing in international regulation from multilateral treaties where an individual government has less control over treaty policy than in the case of purely domestic regulation (Simmons, 2010). For a government, enforcement thus only makes sense if it believes that firms are resilient enough, so that the negative effects on government benefits are minimal.

Figure 1 captures this logic. Only for sufficiently positive prior beliefs to the right of the cutoff $\hat{\sigma}$, a government enforces regulation, but also only against high-type, resilient firms. However, for pessimistic prior beliefs, the government is hesitant to enforce regulation to avoid squeezing firm profits.

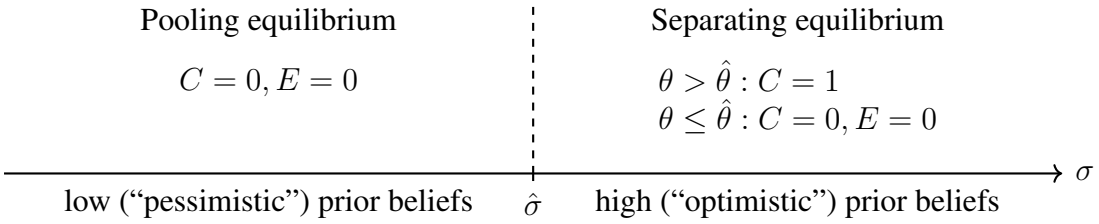

FIGURE 1: *Equilibrium outcomes.* The pooling equilibrium in which no firm complies ($C = 0$) and the government does not enforce ($E = 0$) can only be sustained for sufficiently low prior beliefs about firm resilience ($\sigma \leq \hat{\sigma}$). For high enough prior beliefs, a separating equilibrium exists in which the government enforces penalties only against high types ($E = 1$, for $\theta > \hat{\theta}$), which it knows for sure are resilient enough.

These equilibrium outcomes allow to derive testable implications. Assuming that firm re-

silience, *on average*, is higher when the economy performs well, a government's prior belief that net profits are larger than penalty payments is positively correlated with the state of the economy. In economically stable times, a government can be more confident that net profits θ, at least for high types, are likely high enough, so enforcement is rational. In equilibrium, resilient firms in economically stable times expect this and are more likely to comply.

Hypothesis 1 (Economic stability). *In economically stable times, resilient firms (= high types) are more likely to comply.*

However, once the economic outlook glooms, firm profits likely suffer and net profits reduce. This makes enforcement a risky choice for the government. To play safe and minimize the risk of politically negative effects from "over-regulation," the government no longer enforces international regulation. In equilibrium, firms anticipate this, so compliance rates decrease. Because enforcement is strategic, and governments selectively target resilient, high-type firms in economically good times, the decrease in compliance rates is driven by resilient, high-type firms. These are more likely to change their behavior and no longer comply.

Hypothesis 2 (Economic crisis). *In times of economic crisis, compliance rates decrease as resilient firms (= high types) become less likely to comply.*

Importantly, my theory cautions that enforcement of international regulation is strategic in a double sense. First, enforcement is strategic in that the government selects against what *type* of firm it enforces regulation. Second, a government is strategic about *when* it enforces regulation. This strategic nature of my theory underlies the above derived two *conditional* hypotheses that I now put to an empirical test.

4 Evidence from EU Carbon Regulation

I assess the derived hypotheses with data from European carbon regulation. In 2005, the European Union launched its carbon market, officially the European Union Emissions Trading System (EU ETS), as their flagship policy to reduce carbon emissions from industrial production.[13] This policy meets my theory's scope conditions well.

4.1 Scope Conditions

First, the EU ETS was the EU's joint effort to meet carbon reduction commitments from the Kyoto Protocol, so it operates in the shadow of regulation from an international treaty. Important for my argument, despite EU-wide coordination and burden sharing in some aspects, enforcement rests with national governments (Kruger, Oates, and Pizer, 2007). Compliance is assessed separately for each of the more than 11,000 regulated installations (i.e., plants and manufacturing sites). Specifically, for larger firms, which own more than one production facility and (possibly) operate across several countries, this means that compliance can vary across installations owned by the same company.

Second, the model's informational assumptions nicely map onto regulatory realities in European carbon markets. National governments can perfectly observe non-compliance as this information is centrally recorded by the European Commission and available to governments. Non-enforcement is therefore intentional and unlikely a result of weak monitoring or incomplete information. Instead, the government does not know how regulatory cost affects firm operations, and much of this uncertainty shaped the initial design of the EU ETS policy (Ellerman, Buchner, and Carraro, 2007). Industry successfully lobbied for favorable regulation over fears of negative effects on competitiveness, employment, and firm relocation (Svendsen, 2010; Markussen and Svendsen, 2005). The empirical evidence for such effects however remains mixed (Martin, Muûls,

[13] See appendix A3 for details on the EU ETS.

and Wagner, 2016), but at least some firms—often called "carbon fat cats"—have likely leveraged their informational advantage to make windfall profits from lenient regulation. Consistent with the assumption in my model of strategic enforcement, firms in EU carbon markets hold private information about their resilience to enforced regulation.

Finally, the EU ETS operates in different phases: A pilot phase (2005-2007), a second phase (2008-2012), and an ongoing third phase (2013-2020). As the institutional rules changed significantly after the end of the second phase, including more centralized decision-making by the Commission, I focus on the 2005-2012 years for my empirical analysis. From a research design perspective, holding the institutional context constant is desirable to match the formal model's central assumption that national governments have discretion over whether to enforce penalties or not. The economic recession in 2008/2009 creates variation in economic outlook during these years.

4.2 Spatial and Temporal Variation in Compliance

The main point of my model is that it clarifies that *firm compliance* (and, ironically, not government enforcement) is the meaningful quantity of interest we need to study when we want to understand strategic enforcement. Along the equilibrium path, the government never enforces penalties, so enforcement should theoretically not be an observable action. For the EU ETS, this is indeed the case. The European Commission's summary report on inspection and enforcement recognizes that "[f]ew penalties seem to be imposed," which [m]ight be due to deficits in exerting controls" (European Commission, 2015*b*, 8), and the Commission's overall conclusion is that "inspection of installations and enforcement are weak spots in the EU ETS implementation" (European Commission, 2015*c*, 5). Consistent with my formal argument, the dependent variable in my empirical analysis is installation-level compliance. With installation-year as unit of analysis, the dependent variable scores $Y_{it} = 1$ when installation i complies in year t, and is zero otherwise. Compliance data comes from the European Union Transaction Log (EUTL).[14]

[14] Available from http://ec.europa.eu/environment/ets/allocationComplianceMgt.do?languageCode=en.

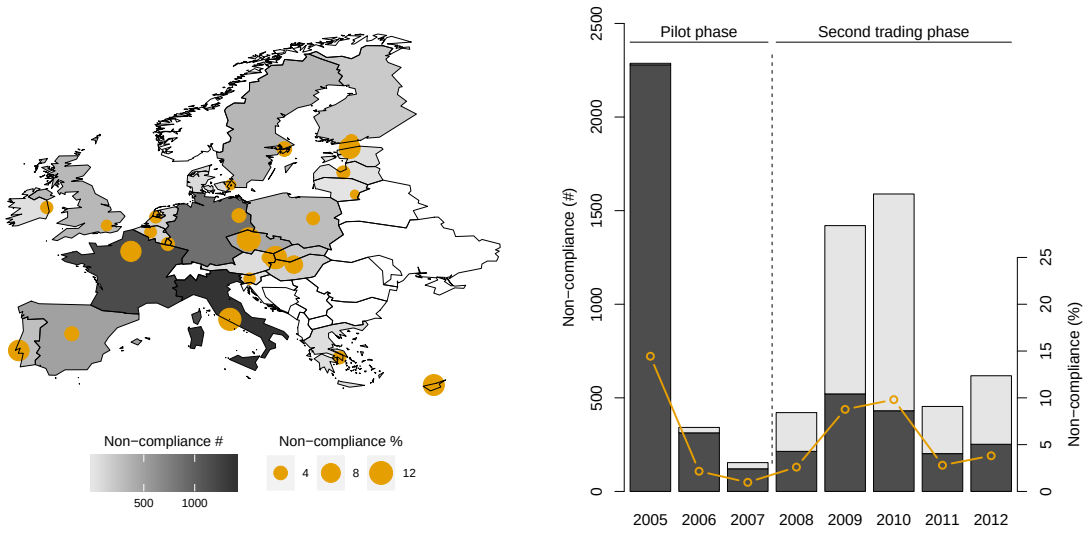

FIGURE 2: *Non-compliance in European carbon markets, 2005-2012.* Left panel: The map shows non-compliance counts for 24 European countries included in the sample, with darker colors denoting more instances of non-compliance. The yellow circles show the share of non-compliant installations per country. Right panel: The bar plot shows counts (left axis) of installation-level non-compliance by year and separately for different types of non-compliance. The dark gray shows non-compliance of not returning enough permits to cover emissions, while the light gray shows non-compliance from non-reporting emissions data.

There are two basic requirements for compliance under the EU ETS. First, at the end of each year's review period, installations have to report their (externally audited) emission levels to an EU-wide registry. Second, each installation has to hold sufficient permits, so called European Union Allowances (EUAs), to cover its emissions. These permits are initially either handed out to installations for free or auctioned,[15] but can also be bought from a secondary market. As in the model, where a firm can pay cost c to become compliant, buying additional permits from the market ensures compliance with European carbon regulation. Non-compliance penalties, r in the model, are steep: €40 (2005-2007) and (2008-2012) for each ton of carbon that is not covered by a permit.

Figure 2 shows non-compliance across Europe and over time. Three interesting patterns arise.

[15] Auctioning of up to 5% (2005-2007) and 10% (2008-2012) of total permits was allowed during the first two trading periods, but only 4% of permits were actually auctioned in the second trading phase (European Commission, 2015*a*). With the reform in 2013, auctioning become the main allocation method, but sectoral exemptions remain.

First, non-compliance is far from negligible. With an average non-compliance rate of 7.5%, roughly 850 installations were non-compliant in any given year. This becomes even more surprising as permit prices were always lower than penalty rates, so buying up additional permits from the market was never prohibitively expensive. At times, permit prices were as low as one tenth of the per-unit penalty rates which were set at deliberately high levels to deter non-compliance (Ellerman, Buchner, and Carraro, 2007). Observing significant amounts of non-compliance *despite* purposeful policy design lends cautious credibility to my theory of strategic enforcement.

Second, non-compliance is fairly equally distributed geographically. It happens across all European countries and is not limited to a handful of "villain" states. Clearly, larger economies with more regulated installations do have higher absolute numbers of non-compliant installations, but this does not mean relative numbers are higher, too. The spatial pattern also rebuts a simple institutional capacity story: non-compliance occurs in EU15 (7.53%) and non-EU15 countries (7.49%) at almost identical rates ($t = -0.144, p = 0.885$).

Third, non-compliance varies considerably over time. The first year is likely an outlier because firms were unfamiliar with carbon markets. The rise of non-compliance in 2009/2010 is telling as it runs counter to the notion that non-compliance should be lower during economic downturns. The logic here seems compelling: as the economy slows, output decreases and with it carbon emissions, so that firms need fewer extra permits from the market; compliance becomes cheaper and non-compliance should go down. However, this intuition misses my theory's central point that firm compliance is a response to (strategic) government enforcement, which goes down during an economic crisis. Therefore, according to my argument, non-compliance should go up, as the data show it indeed did midway through the second trading period. Adding to this, what drives non-compliance in crisis years is non-compliance from non-reporting of emissions data. This is insightful as I shall argue below that installations can use the *type* of non-compliance to more credibly signal their (non-)resilience to an enforcing government.

Results from Interaction Models

The evidence presented so far reveals useful spatial and temporal patterns in EU carbon regulation that are consistent with my argument about strategic enforcement. A more systematic test of my hypotheses requires establishing a link between a firm's resilience, the performance of the economy, and observed compliance behavior.

Measuring resilience is difficult. Resilience is private information and therefore cannot be known by either the government (as in the formal model) or the analyst. Whether enforcing penalties would indeed squeeze profits enough to make a firm relocate or lay off employees (because of the penalty) remains a firm's secret. Despite this complication for measuring resilience at the installation level, I can use *sectoral* information to get at how enforcement affects an average firm in any given sector.

In the energy sector, for instance, firms can pass on large parts of their regulatory cost, including enforcement penalties, to customers through increased electricity prices (Martin, Muûls, and Wagner, 2016). This is not true for firms in sectors that face fierce international competition, such as manufacturing. For that reason, enforcing penalties against resilient power utilities unlikely results in offshoring, employment loss, or capital divestment when compared to enforcement against much less resilient aluminum or steel producers (Newell, Pizer, and Raimi, 2014). Therefore, I use an electricity sector dummy (NACE division 35) as a resilience measure.[16]

The effect of firm resilience, in my model, is conditional on a country's economic performance. During an economic crisis, even resilient, high-type firms do not have to fear strict government enforcement and their compliance rates decline. For my interaction models, I code a binary indicator variable that is equal to 1 for country-years in which lagged growth rates are negative, based on

[16] NACE Rev.2 sector codes for installations regulated under the EU ETS come from the European Environment Agency (EEA) "EU Emissions Trading (ETS) Data Viewer" (available at https://www.eea.europa.eu/data-and-maps/dashboards/emissions-trading-viewer-1), and have been consolidated against data from the European Union Institute (EUI) "Ownership Links and Enhanced EUTL Dataset Project" (available at http://fsr.eui.eu/climate/ownership-links-enhanced-eutl-dataset-project/).

World Bank *World Development Indicators* data.[17] Albeit a simple measure, it captures country-variation in economic performance and it correlates highly (in its non-lagged version) with the recession in 2008/2009 ($\rho = 0.552, p = 0.000$).[18]

All models presented below include the logged number of allocated permits and logged emission levels to account for differences in permit endowments and installation size. Year fixed effects control for common time trends, while country and sector fixed effects minimize confounding from time-invariant country and sector heterogeneity.[19] Models (1)-(3) present findings for the full sample, when only the set of included fixed effects varies. Models (4) and (5) show sub-sample analyses for the second trading period (2008-2012) and EU15 member states. For ease of interpretation, I report OLS results here and logistic regressions, with identical results, in the appendix.

TABLE 1: Main results from interaction models

	DEPENDENT VARIABLE: Compliance (0/1)				
	Full sample			Post-2007	EU15
	(1)	(2)	(3)	(4)	(5)
Resilient firm	0.024***	0.011***	0.026***	0.030***	0.033***
	(0.002)	(0.002)	(0.008)	(0.008)	(0.009)
Resilient firm ×	−0.012***	−0.011***	−0.010***	−0.008**	−0.016***
Economic crisis	(0.004)	(0.004)	(0.004)	(0.003)	(0.004)
Economic crisis	−0.005	0.001	0.002	−0.001	0.001
	(0.003)	(0.004)	(0.004)	(0.003)	(0.004)
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Country fixed effects	No	Yes	Yes	Yes	Yes
Sector fixed effects	No	No	Yes	Yes	Yes
Non-compliance rate	5.1 %	5.1 %	5.1 %	3.0 %	5.0 %
N	82,898	82,898	82,898	52,817	67,696

Note: Models control for allocated permits, log(allocation+1), and emissions, log(emissions+1), both at the installation level. *p<0.1; **p<0.05; ***p<0.01

[17] Appendix A4 shows that actual growth rates instead of the binary indicator variable produce qualitatively similar results. A placebo test demonstrates that results reported below weaken when using a non-lagged binary indicator variable. This attests to the validity of the measure, as in April of each year t, a firm makes its compliance decision for the previous year $t-1$, so lagging variables is critical.

[18] Indeed, out of the 49 country-years with negative growth rates, 32 (65%) occurred during the 2008/2009 recession year. In 2009, all countries except for Poland had negative growth rates.

[19] Sector fixed effects are constructed from ten EU ETS "Main Activity Codes" (e.g., combustion, oil refining) and come again from the EEA and EUI sources mentioned in footnote 16.

Across all models, resilient installations in non-crisis years are better compliers than less resilient ones: on average, a resilient firm is roughly between 1-3 percentage points more likely to comply. In view of non-compliance rates between 3-5%, these are non-trivial effects. Consistent with the theoretical expectation, resilient installations become less compliant once the economy slips into recession. These patterns hold equally for post-2007 years and EU15 member states.[20] Despite this attenuation in compliance during crisis years, resilient firms—except for model (2)—continue to comply more than their less resilient counterparts, albeit at lower levels. Notably, the formal model captures behavior on the margin, not in levels, so the empirical evidence supports the two hypotheses formulated above.

5 The Signaling Mechanism: Types of Non-compliance

A key aspect in the formal model is that firms signal private information to governments. While empirically tracing this mechanism is difficult, I show that the type of non-compliance reveals useful insight. As mentioned above, compliance in EU carbon market requires for firms to, first, report their emissions and, second, to surrender permits to cover their emissions. Non-compliance can therefore be of the "non-reporting" type, where an installation would not enter emission information into the European Commission's database, or of the "non-surrendering" type, where too few permits are returned.

For not surrendering sufficient permits, carbon market rules set pre-defined, EU-wide, automatic penalties (e.g., €100 during 2008-2012, per each ton of carbon that is not covered by a permit). Non-reporting, on the other hand, triggers an informal review process that facilitates communication between a non-compliant installation and the government. I argue that firms that are in need to signal private type information to a government can therefore use non-reporting as an

[20] Appendix A4 shows the same is not true for EU10 countries. Eastern EU member states did not suffer from the economic crisis as much as EU15 countries did, differences in sectoral composition result in a higher proportion of resilient installations from the power sector, and notorious ETS implementation problems in Poland and massive over-allocation of permits in the Baltics all suggest that the regulatory environment and the scope for strategic enforcement may be quite different in EU15 and EU10 countries.

informal communication device. If a firm does not provide emission information voluntarily, it forces the government to engage in a conversation. During these talks, the firm can seek to convince the government that it is of the low type, and regulation should not be enforced against it. Following this line of argumentation, which derives from the model's informational logic, out of all non-compliant firms, the ones that are greatly burdened by environmental regulation should be more likely to not report their emissions. I test this expectation.

Measuring non-reporting is straightforward and data come again directly from EUTL. Identifying low-type installations is more problematic. Any measure to proxy for low-type installations must discriminate well among the *subset of non-compliers*. Rather than explaining the difference between compliance and non-compliance, as above, this analysis explains variation in the *type* of non-compliance between non-reporting and non-surrendering. Conditional on being non-compliant, I argue that plant closure is a good indicator to identify the most vulnerable installations in EU carbon markets. Indeed, if a plant shuts down its operations, this gets at the very heart of being non-competitive. Plants that close are therefore, by definition, the least resilient ones. For my measurement strategy, the reason for plant closure does not matter and, in particular, it does not have to be the result of carbon market regulation. Rather, installations that struggle and ultimately close are more likely to not report their emissions. In keeping with my argument, this is to enter into an informal compliance review with the government where private type information can be revealed.

The EUTL database contains information on whether an installation's permit account has been closed. As installations that meet the regulatory criteria to come under the EU ETS are forced by law to participate in it (which requires having an open account), an account can only be closed if the installation that holds the account shuts down.[21] The variable is installation-specific and time-invariant: it captures that an installation's account has been closed at some point during the study

[21] Article 24 of Directive 2003/87/EC allows for voluntary opt-ins, but numbers are small. In my data, only 1% of installations are opt-ins and virtually none of them (0.4%) end up with a closed account.

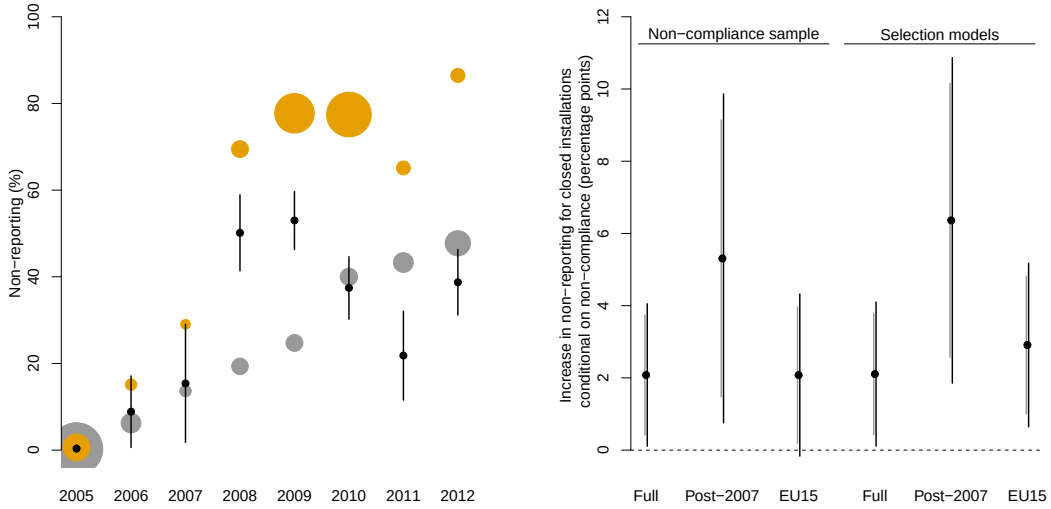

FIGURE 3: *Non-reporting in European carbon markets, 2005-2012.* Left panel: The plot shows the share of non-reporting among non-compliers by year and separately for installations with closed (yellow circles) and open (gray circles) accounts; the area of the circles indicates sample size. The black dot and error bars show the first difference in non-reporting across groups with the associated 95% confidence interval. Right panel: The plot shows coefficient estimates with 95% (black) and 90% (gray) confidence intervals for non-compliers with closed accounts from three regression models for the full sample, the second trading period, and EU15 member states. The first three estimates come from models that only include non-compliers, the second three estimates are second-stage coefficients from a two-step selection model.

period, but not in what year.

Across all years, non-compliers with closed accounts are more than four times as likely to not report their emissions than non-compliers with open accounts. The average share of non-reporting relative to non-surrendering is 64% among installations with closed accounts, but only 15% for those with open accounts ($t = 47.91, p = 0.000$). The left panel in Figure 3 further disaggregates this pattern over time. The yellow (closed accounts) and gray (open accounts) circles show the average share of non-reporting by year, where the area of the circles indicates sample size. Black dots show the difference in these shares with associated 95% confidence intervals as error bars.

As with aggregated data, non-reporting is more prevalent among non-compliers with closed accounts, and by a large margin so. However, non-reporting also becomes more popular during

the later years among all non-compliers. This is fully consistent with my argument about strategic enforcement. When firms become under pressure as the economy shrinks, the need to signal low resilience to the domestic government increases in order to avoid additional burden from strictly enforced regulation. This logic applies across the board, both to installations that just survive (i.e., ones with open accounts) and those that shut down (i.e., ones with closed accounts).

Regression models complement this evidence: non-compliers with closed accounts are more likely to non-reporting than open account counterparts. The right panel of Figure 3 shows estimated coefficients for three different samples (full sample, post-2007 period, and EU15 member states) and two types of models (OLS regressions for non-compliance sample and selection models).[22] Coefficients are comparable in size and statistical significance across models and allow for the following substantive interpretation: when an installation is non-compliant with certainty, that is, its non-compliance probability is 1, having a closed account makes non-reporting about 2-5 percentage points more likely.[23] While these results likely underestimate the true effect, because of the time-invariant closed account measure, the analysis lends credibility to the formal model's signaling mechanism. Firms consciously decide about the type of non-compliance, and use non-reporting to convey private type information to the regulating government. This is in line with my argument about strategic enforcement.

6 Conclusion

Why do governments enforce international regulation at some times, but not at others? In this paper, I argue that governments are strategic in their enforcement of penalties when firms violate regulation from international agreements. More specifically, governments are strategic in two

[22] Appendix A5 discusses technical details (e.g., model specification, exclusion restriction) and offers a more complete interpretation.

[23] Models report OLS coefficients for direct interpretation. By assuming a non-compliance probability of 1, the second-stage "closed account" coefficients from the two-step selection model become immediately comparable to the estimated coefficients from OLS models that only use the non-compliance sample. Fairly low estimated error correlations of not more than $\rho = 0.15$ across models, explain the similarity in estimates across different estimation strategies.

ways. First, they are strategic about against what *type* of firms they enforce penalties. Second, they are strategic about *when* they do enforce penalties. Building on a formal model of incomplete information in which a government is uncertain about how penalty payments affect a firm, a government only enforces penalties against the most resilient firms, and also only when the economy performs well. I test this argument against a novel dataset of more than 11,000 installations that are regulated in European carbon markets over eight years, 2005-2012. Evidence from various tests support my argument of strategic enforcement: Governments are hesitant to enforce penalties against firms that struggle. Firms, on the other hand, use a specific type of non-compliance, i.e., not reporting their emissions, to communicate important private information to governments and convince governments of their low resilience to environmental regulation.

This finding has at least two broader implications. For one, the argument that governments are strategic in enforcing *international* regulation is likely to extend to enforcing domestic regulation as well. We know that governments are strategic in how they interact with firms (Gordon and Hafer, 2005) and other (subnational) governments (Konisky and Teodoro, 2016). What makes international regulation a good point to start is that regulation from multilateral agreements has a high likelihood to not perfectly reflect a government's domestic interests because of international bargaining. If interests do not fully align, governments have an incentive to sacrifice the global good to avoid domestic damage. However, the same situation can arise from domestic regulation as well if it is a compromise policy between coalition parties or the result of divided government. Whenever enforcing regulatory policy is likely to cost votes, such as in energy policy where distributional effects can be large (Bayer and Urpelainen, 2016), the logic of strategic enforcement should travel to domestic regulatory politics as well.

Second, the paper makes a cautionary note about testing the effects of international institutions. In the context of this paper, the European Union clearly met its greenhouse gas reduction targets under the Kyoto Protocol. However, what looks like a clean slate at the *country*-level, becomes a much muddier picture at the *installation*-level. When looked at it that way, EU-wide carbon

reductions did all of a sudden no longer occur because everyone played by the rules, but rather despite the non-compliance by some. Obviously, the unit-of-analysis matters for our conclusions of how effectively institutions functions as Rose (2004) and Goldstein, Rivers, and Tomz (2007) show for the GATT/WTO.

Compliance with international regulation often requires cooperation between governments and firms. Governments depend on firms for implementation (Simmons, 2010). Despite this link, we know relatively little about how government-firm interaction shapes national compliance from the bottom up, not least because of data limitations. This paper therefore breaks new ground by presenting an argument about strategic enforcement of international regulation that accounts—both theoretically and empirically—for government-firm interaction. Complementing recent works into the role of firms in international politics (Osgood et al., 2017; Osgood, 2017), my findings from environmental regulation advance this area of research beyond trade policy.

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