



# Implicit incentives in green public procurement: Good intentions versus rigid regulations

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## ABSTRACT

Governments promote pro-environmental behavior explicitly, through regulatory provisions, or implicitly, by setting general environmental objectives without explicit requirements. Shared values and commitment to government objectives supposedly help towards greener behavior. We argue that the lack of explicit guidance counteracts, especially if green options are perceived as conflicting with strict regulatory requirements on other issues. In Russian public procurement, organizations are subject to either a rigid procurement law, or a flexible law, or both; neither law formalizes environmental priorities or approaches. We design a survey on practices of green procurement, collecting 223 responses from the whole range of organizations subject to public procurement regulation. Results from probit regressions, robustified on further 800 responses from an additional survey and 250,000 official procurement records, show that regulatory rigidity hinders green practices. Federal authorities are more likely to apply environmental criteria than local governments, but this is rather due to the expertise of their staff than to their commitment to governmental objectives. Publicly funded institutions are less likely to adopt green procurement than state corporations. Caution and avoidance of unintended contraventions seem to impede adoption of green procurement. Provision of information, guidance and improved expertise can help overcome this effect.

## 1. Introduction

Environmental protection is prioritized by most governments; public authorities are encouraged to use environmental criteria in procurement. In some countries provisions for this are embedded in public procurement regulations. In others, there is no formal requirement to do so but public authorities may still adhere to green procurement, aligning their procurement practices with the government priorities, or responding to the pressure from other institutions (values, goodwill, desire to be seen as a keen government supporter are among factors potentially contributing to such an alignment). These act as implicit incentives (Meyer and Vickers, 1997): governments and other institutions may stimulate organizations to behave pro-environmentally with no explicit legal requirements to do so. In a recent work, Raj et al. (2020) highlight institutional, and in particular regulatory, pressure, as a significant factor of green procurement. We extend this view

by focusing on the interaction between formal and informal institutions: while the latter create implicit incentives to act green, the former may counteract through excessive pressure on other issues and resulting general caution in decisions.

To this end, we investigate how the practices of organizations subject to public procurement regulation in Russian Federation (RF), which covers public bodies as well as enterprises that are fully or partly financed from the public funds. Environmental protection is not emphasized in the public procurement legislation in the RF, in contrast with other developed countries, for example, the EU.<sup>1</sup> Nevertheless, as we show, RF public procurement entities do apply environmental criteria in procurement. Such a behavior may be a powerful mechanism to promote environmental goals: sustainable policies and practices of public organizations extend beyond their boundaries to the whole supply chain (Meehan and Bryde, 2011) and stimulate environmental innovations in the local area (Orsatti et al., 2020). The question is whether

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<sup>1</sup> See, e.g., the European Commission Communications 'Public procurement for a better environment' (COM(2008)0400) and 'Europe 2020 – a strategy for smart, sustainable and inclusive growth' (COM(2010)2020). The environmental protection goals are defined in the EU directives on public procurement (Directive 2014/24/EU; Directive 2014/25/EU) and in the national legislation of European countries regulating public procurement.

it could be further stimulated without introducing explicit regulatory norms. We argue that the general regulatory context affects pro-environmental decisions: organizations subject to a rigid regulation on other issues, avoid using environmental criteria even if these are not forbidden in procurement.

We make use of the following feature of the Russian public procurement system: organizations are subject to two different legislations – the Federal Law 44FZ, which covers all government (federal, regional and municipal) bodies and publicly financed institutions, and the 223FZ, which applies to state-owned corporations, natural monopolies, and other companies with over 50% state participation. Publicly financed institutions that are allowed to engage in profit-generating activities, are governed by the 44FZ when spending public funds, and by the 223FZ when spending the extra revenue generated.<sup>2</sup> The 44FZ rigidly regulates the entire procurement process from the planning and the selection procedure to the completion of the contract. The 223FZ is a framework law that formulates the basic principles and the key rules of the procurement process.<sup>3</sup> Neither legislation contains requirements or prohibitions to include environmental criteria in the procurement procedures. The two bits of legislation that differ in rigidity but not in the environmental requirements give us an opportunity to investigate the role of general regulatory rigidity in environmental decision-making.

In 2017–2018 we conducted a survey of 275 organizations subject to public procurement regulation from 22 Russian regions. These are government bodies, [partially] state-owned companies and public institutions. Our data details sources of their information on environmental criteria, adoption of an organization-wide procurement strategy, existence of dedicated procurement departments, etc. As our key point of interest, we measure three levels of adoption of environmental criteria in procurement: (Aragon-Correa et al., 2020) whether respondents ever applied any environmental criteria in their procurement practice,<sup>4</sup> (Armstrong and Overton, 1977) whether respondents repeatedly did so, and (Bollinger and Hirsch, 2013) whether respondents ever applied life-cycle costing (LCC) in their procurement practice. The life-cycle costing is arguably a more advanced criterion, compared to environmental friendliness, as it requires an estimation of additional costs such as consumption of energy and other resources, maintenance and end of life (recycling) costs, environmental externalities, on top of the acquisition cost; the contracting authority is supposed to publish both the data to be provided and the method that would be used to calculate the LCC.<sup>5</sup> The three variables allow us to judge on the degree to which contracting authorities have accommodated environmental priorities in their procurement practices. We then estimate probit regressions to elicit factors that drive the adoption of pro-environmental principles in procurement at different levels: rigid legislation dampens green procurement practices (GPP) while better awareness and expertise reduce the negative effect of regulatory rigidity. Results are robustified on further 800 survey data and 250,000 of official data on public procurement procedures.

Our paper directly relates to the literature investigating the role of institutional pressure in promoting pro-environmental behavior (see, e.g., Raj et al., 2020, and references therein). With a focus on private businesses, Kazancoglu et al. (2021) find the lack of legislation, and mandatory requirements (both examples of formal institutions), as well

as lacking government support and environmental awareness of government bodies impede the spread of pro-environmental business solutions. Similar factors are echoed by Liu et al. (2019) and Rosell (2021) for public procurement. We take the perspective that when mandatory requirements are missing, and green procurement is driven mainly by informal institutions (see Section 2 below), legislative rigidity may be harmful. Generally, mandatory approaches (rules and norms stemming from legally constituted authorities) are well-documented to exert a powerful impact on pro-environmental behavior of organizations (e.g. Christmann, 2004; Darnall et al., 2010; Raj et al., 2020), yet criticized for inefficiency, being too rigid and restrictive for firm-level decision-making (e.g. Jaffe et al., 1995; Kim et al., 2017). Although there are generally positive views on voluntary approaches, which institutionally derive from other sources (sometimes not legally constituted), such as non-government organizations, standards organizations, civic organizations, literature also reports their deficiencies (e.g., free-riding, adverse selection, moral hazard, see Steelman and Rivera, 2006; Testa et al., 2018). On a balance, a consensus seems to be that alone, voluntary approaches may lack effectiveness and therefore need to be complemented by explicit requirements and penalties for non-compliance (Aragon-Correa et al., 2020). In our paper, neither voluntary nor mandatory provisions with respect to green procurement are present, however there are more general mandatory provisions with respect to public procurement overall. We argue the effectiveness of the informal institutional pressure towards more pro-environmental behavior can be improved by relaxing existing regulations on adjacent, non-environmental, issues.

## 2. Theoretical framework

Our argument nests in the institutional theory, which has a broad focus on the development of institutions, both formal and informal, that shape behavior of people and organizations (DiMaggio and Powell, 1983; Meyer and Rowan, 1977; North, 1990, 1997, 2005). Formal institutions include regulatory norms, legislative rules, formalized policies, while informal institutions refer to culture, traditions, customs, moral values, among other (North, 2005; Scott, 2008; Casson et al., 2010). Institutions determine incentives for people and organizations to take one or another action (e.g. Bull, 1987; Stiglitz, 1998; in Matten and Moon, 2008, incentives are part of institutions themselves). Implicit incentives in our context are to a large extent defined by informal institutions, e.g. the extent to which caring about the environment belongs to the traditions and values of the society. Governments, representing formal institutions, may add to this effect by declaring environmental protection a national priority.

Formal institutions define rules that are explicit, yet these may be in the form of mandatory regulatory provisions with which organizations are legally required to comply, or obligations taken by organizations voluntarily, arising through membership in associations, voluntary certification schemes, or alike (Aragon-Correa et al., 2020; Potoski and Prakash, 2005). The latter may be further reinforced by such informal institutions as shared values, beliefs, social customs, codes of conduct (North, 1990; Sartor and Beamish, 2014; Hörisch et al., 2017). The set of institutions and the channels of their effect on actions through explicit and implicit incentives are in Fig. 1, where dotted arrows highlight the interaction between formal and informal institutions in shaping incentives. To highlight the specific feature of the Russian procurement system, we fade out and use dashed lines for the explicit incentives channel: as explained in the Introduction (and, in more detail, in Appendix A), at least at the time of this study, in Russia neither the relevant laws set any requirements for public organizations to include environmental criteria in their procurement procedures, nor there are any voluntary schemes that would impose obligations on organizations to adhere to green public procurement. The key driver of green procurement in Russia is therefore in implicit incentives, determined by informal institutions (such as values) and reinforced by the declared

<sup>2</sup> For example, universities are publicly financed yet can take students on a paid basis, this brings them under 44FZ for spending the public money, and under 223FZ for the remainder.

<sup>3</sup> The English-language literature discussing the two laws is rather scarce, some discussion may be found in Sirotkina and Pavlovskaya (2018). We offer a description of the Russian public procurement system in Appendix A.

<sup>4</sup> This factor is quite common in the literature, see e.g. Liu et al. (2019).

<sup>5</sup> The EU regulatory prescriptions on LCC in public procurement can be found in EC Directives 2014/24/EU (Article 68) and 2014/25/EU (Article 83).

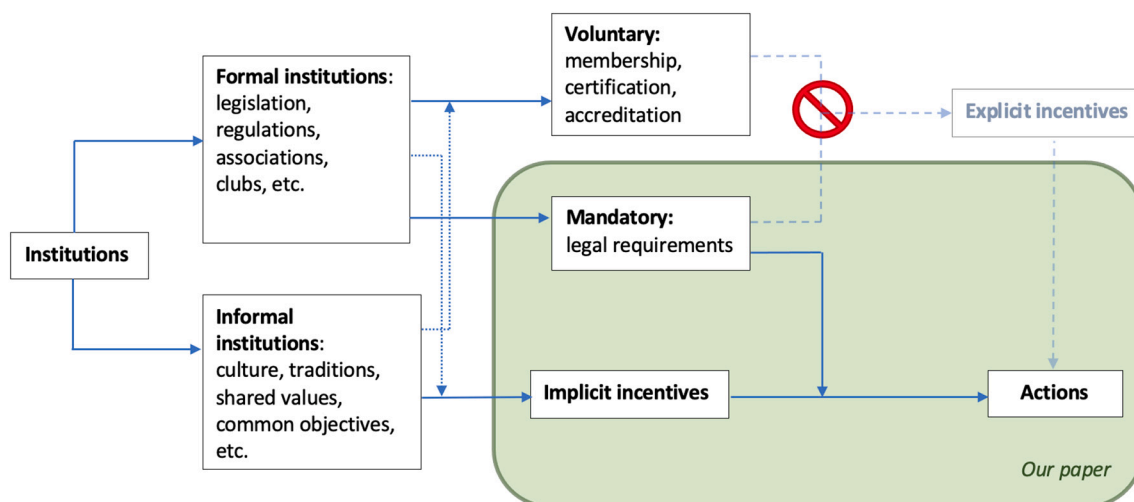


Fig. 1. Theoretical framework and positioning of the paper in the broader theory.

environmental objectives of the government. We refer to this institutional pressure as “environmental priority”.

However, even if explicit incentives to act green are not present, organizations take decisions within a wider institutional context. We posit that regulations that govern other activities of organizations, have their impact on the way implicit incentives for pro-environmental decisions work. In particular, if an organization is subject to a very strict and prescriptive procurement regulation, it may develop a habit of implementing a certain type of procedures that clearly meet regulatory provisions. Deviating from these habitual procedures towards inclusion of environmental criteria, may be perceived as a trigger of potential additional compliance cost and even high risk of violating the law, and as such undesirable (see, e.g., [Gerardino et al., 2017](#), where audit shifts public procurement from complex procedures towards those that are easier to implement and require less checks). Formal institutions in this framework interfere with the effect of informal institutions twice: first, when a government reinforces implicit incentives by declaring the overall environmental objectives, and second, when rigid regulations shape organizational behavior in a way that counteracts the effect of implicit incentives.

Organizations are usually assumed free to decide on the degree of adoption of certain practices (e.g. [Laffont and Tirole, 1990](#); [Morand, 2003](#); [Shen et al., 2017](#); [Raj et al., 2020](#); [Jehiel et al., 2020](#)). Appendix A formally models the decision of an organization with respect to fraction  $\alpha$  of green procurement procedures in the total procurement volume. The government might create an *explicit incentive* by imposing a constraint  $\alpha \geq \underline{\alpha} > 0$ , enforcing a strictly positive share of environmental procedures in public procurement. We focus on the case when the government does not set any constraints of this type, yet it may still communicate the high priority of environmental protection, which would work as an *implicit incentive* for organizations and signal that green procedures are preferred. Implicit incentives have been originally formalized by [Meyer and Vickers \(1997\)](#), [Holmstrom \(1999\)](#), [Che and Yoo \(2001\)](#) in the context of work contracts, where reputational concerns and peer pressure play an important role. With respect to environmental concerns, [Karp \(1996\)](#) explicitly associates willingness to act pro-environmentally with good citizenship and willingness to adhere to norms (hence the link to informal institutions); [Yang et al. \(2019\)](#) discuss the willingness of investors to act pro-environmentally and their concerns about the corporate image. If aligning with the green objectives is beneficial (in a non-pecuniary sense) for the organization, yet an anticipation of complicated audit or unintended procedural mistakes induces perceived cost  $A$ , the fraction of environmental procedures an organization wishes to run is a function of non-pecuniary benefits  $B$  and

this anticipated cost  $A$ . The following representation (see Appendix A for derivation) helps highlight the interaction of the two effects:

$$\alpha = 1 - \frac{A}{B} \text{ if } A < B \text{ and under environmental priority,}$$

$$\alpha = 0 \text{ if } A \geq B \text{ or without environmental priority.}$$

Pressure from both informal and formal institutions towards more green procurement not only ensures  $\alpha > 0$  but also makes  $\alpha$  positively depend on benefits  $B$  from aligning with this imperative, and negatively – on the anticipated cost  $A$ . The latter effect (avoidance of extra cost, or caution) discourages green procurement and acts against implicit incentives. It is shown in [Fig. 1](#) as a moderating impact of the system of mandatory regulations on the way implicit incentives shape green actions.

This framework has several implications. First, if implicit incentives are reasonably strong, we should observe a strictly positive share of public procurement procedures with environmental criteria. Second, this share should be lower for organizations that are governed by a more rigid law, as their anticipated compliance cost  $A$  is higher than for organizations that are subject to a less restrictive regulation. Third, heterogeneity of the cost-benefit ratio ( $A/B$ ) among organizations would imply different degrees of adoption of green procurement by different types of procurement entities (for example, organizations at a higher level of public power hierarchy may have stronger incentives to demonstrate alignment with the national priority, hence higher  $B$ , and are more likely to have better qualified staff, for which reason the anticipated cost  $A$  would be low, resulting in a low cost-benefit ratio and a high degree of adoption of green practices). Fourth, better expertise with respect to the application of environmental criteria would reduce anticipated compliance cost  $A$ , and as such, lead to a higher adoption of environmental criteria in procurement and reduce the negative effect of the rigid law.

### 3. Data & methodology

To collect the data, we conducted a survey of organizations governed by the Russian public procurement legislation in their procurement activities. As usual in this type of surveys (see, e.g. [Clemens, 2006](#), for the impact of environmental incentives on scrap steel firms in the U.S., [Skordoulis et al. \(2020\)](#) for environmental attitudes of Greek firms, [Doroshenko et al. \(2014\)](#) and [Vinogradov et al. \(2018\)](#) for procurement of knowledge-intensive services in Russia), the questionnaire is answered by relevant employees, i.e. professionals responsible for the procurement activities in public institutions, publicly funded

organizations, and private companies with a state participation. This helps us obtain a unique insight into the environmental procurement in the Russian public sector. Our survey took place in 2017–2018.

### 3.1. The questionnaire

Our objective was to have a questionnaire that covers: (a) environmental criteria used (if at all) in procurement, (b) the organizational specifics like the existence of the procurement department, procurement strategy, the annual volume of procurement, etc., and (c) whether there are any perceived information frictions with respect to the usage of pro-environmental approaches in public procurement. Dimensions (b) and (c) are particularly useful to proxy for perceived costs of using environmental criteria. We kept key questions consistent with other surveys in this field, such as the UN global monitoring of sustainable procurement in 2013 and 2017 (*Global Review of Sustainable Public Procurement, UN, 2017*) and the survey of environmental (green) procurement in the EU (Bouwer et al., 2006).<sup>6</sup>

Overall, the questionnaire consists of 16 questions.<sup>7</sup> The full questionnaire is in Appendix B. Our main focus is on questions that characterize the usage of environmental criteria, such as “Which criteria does your organization use in procurement?” and “Does your organization use the lifecycle cost analysis in the procurement process?”. The survey includes questions that we use to identify the type of the organization: “From which region of Russia are you and your organization?”, “What type of organization are you working for? (federal/regional/municipal etc.)”, and “What is the annual volume of purchases in your organization per year (in rubles)?”. The type-of-organization question above also identifies whether the organization is subject to 44FZ, 223FZ or both. Other questions identifying the type cover the procurement department and procurement policy in the organization. We also ask questions that shed light on the information factors important for decisions to include or not the environmental criteria in procurement: where organizations find information on environmental standards, whether respondents see themselves skilled in terms of environmental awareness, and whether they believe there is a need in environmental procurement standards. Section 4.3. provides further details on main questions and variables constructed from them.

### 3.2. The sample

Target population in our study are organizations subject to public procurement regulation. The structure of the Russian public administration includes three levels of power: federal, regional (in every of 85 Russian regions) and local (almost in every city and territory). On top of that, public procurement legislation covers organizations beyond the administrative segment. Accessing and collecting detailed micro-level data from all these organizations is not feasible. Instead, data is collected on a suitable and accessible sample group. Inclusion of authorities from different governmental levels, operating under different legislative frameworks, as well as a variety of other organizations subject to the same regulation, was a pre-requisite for data collection.

Several channels were used to invite respondents to participate in the survey. First, we approached participants of the training programs for public procurement professionals of which we were aware when we launched the survey. To do so we emailed heads of regional public procurement training centers in Moscow, St. Petersburg, Perm, Rostov and Irkutsk. The target audience at these programs was about 500

participants altogether. Second, we contacted regional sections of the Russian Guild of Public Procurement Specialists with a request to disseminate the questionnaire link between the members of the Guild (including public procurement specialists, experts, and instructors/trainees) – this covers 68 regions. On top of that, we contacted the Ministry on public procurement regulation in Perm Krai, and Sberbank AST, the leading e-procurement platform, with a request to disseminate the invitation to take part in the survey among organizations under their supervision. We also asked participants of the survey to invite other participants from other organization, thus enabling the snowballing effect. Overall, we estimate our invitation should have reached about 1000–1500 potential participants. Through all these channels, we received 275 responses overall, out of them 52 were incomplete in the sense of missing either one of the key dependent variables or the majority of explanatory data, leaving us with 223 (=275–52) complete responses (see Table 1 in Section 4.3 for completion rates per question).<sup>8</sup> The response rate of 25–30% is reasonably good compared to other unincited surveys (see, e.g., Coibion et al., 2020, who report, in particular, a 5–10% response rate on Qualtrics, one of the leading online survey platforms), the total size of the resulting sample compares favorably with other studies of this type (Clemens, 2006; Li, 2014; Liu et al., 2019; Skordoulis et al., 2020; and others).

This approach provides us with a sample that includes organizations of all types of public bodies in Russia, a wide variety of organization sizes, and both laws that regulate the system of public procurement in Russia. Moreover, the sample covers 22 regions of the Russian Federation, including the capital region (Moscow, Moscow Oblast), and the periphery (Perm Krai, Rostov Oblast, Saratov Oblast, and other). Among them, procurement activities of 118 organizations are governed by the law 44FZ and those of 105 organizations under 223FZ (these include a subsample of those governed by both laws). 137 organizations report having a dedicated procurement department/service; about half of the organizations report their annual procurement volume under 10 million rubles per year (about USD 180 K at the time of the survey), a threshold we later use to distinguish between small and large organizations. 76 organizations report having a formal procurement strategy, though it does not reflect environmental criteria; only thirteen have a procurement strategy that includes eco-criteria. The majority of respondents indicated a lack of knowledge in environmental procurement. At the same time, 106 respondents answered that they would be happy to learn and acquire the necessary expertise. The majority of respondents (158 organizations) indicate there is a need in model environmental criteria which should be developed by the Government or by non-profit organizations.

While this data collection procedure is widely adopted, caution should be taken due to potential sampling, nonresponse and selection errors. The *sampling error* might arise if the sample is not representative of the general population, in which case results may not extrapolate to the general case. We address this issue by ensuring all *types* of organizations subject to public procurement are included in the sample (both subject to each of the two laws, and the types governed by each law – federal, regional and municipal public bodies governed by 44FZ, as well as state corporations and federal budget-funded organizations governed by 223FZ), and a range of sizes and regions are covered. While the sample may lack representativeness in terms of stratification to the distribution of these types in the general sample (stratification could change proportions of types in the collected sample), the within-sample variations across these main types allow us to conduct a regression analysis of the impact of the type on the decision variables. This

<sup>6</sup> Neither of the two covered Russia; their questionnaires are quite extensive, covering over 45 questions each.

<sup>7</sup> We keep the number of questions low to ensure a reasonable completion rate: an increase in the number of questions leads to a decrease in the motivation of respondents to answer the questionnaire completely and truthfully (Vinogradov and Shadrina, 2013).

<sup>8</sup> Using responses with the highest number of completed questions contributes to the likelihood of having true and unbiased answers in the sample Vinogradov and Shadrina (2013). Hair et al. (2014) also suggests removing observations with less than 70% completed questionnaires helps improve precision.

**Table 1**  
Variables and descriptive statistics.

Variable	Description	$N_{resp}$	Mean	Question
<b>Environmental criteria</b>				
ECO	Usage of environmental criteria in procurement: Eco = 1 if organization applies environmental criteria in purchases, zero otherwise.	264	0.60	Q6
ECOnoEn	Usage of environmental criteria in procurement with no energy efficiency criteria: Eco = 1 if organization applies environmental criteria in purchases (any, but without requirements for energy saving and energy efficiency), zero otherwise.	264	0.39	Q6
RepECO	Regular usage of environmental criteria: $Y_{eco,q} = 1$ if environmental criteria are used “almost always” “often”, “often enough” or “rarely”, $Y_{eco,q} = 0$ if the environmental criteria are used “almost never” or “not at all”.	223	0.36	Q8
LCC	The usage of the life-cycle cost (LCC) criterion: LCC = 1 if the LCC-criterion is ever used in procurement procedures, zero otherwise.	223	0.26	Q11
<b>Institutional factors</b>				
RigidLaw	Legal subordination of procurement activities: RigidLaw = 1 if the all procurement procedures of the respondent fall under 44FZ, RigidLaw = 0 if at least some of them fall under 223FZ (RigidLaw = 0 includes respondents governed by both laws).	275	0.52	Q2
FlexLaw	Legal subordination of procurement activities: FlexLaw = 1 if all procurement procedures of the respondent fall under 223FZ (respondent is either a corporation or a limited liability company), zero otherwise (FlexLaw = 0 includes respondents governed by both laws).	275	0.3	Q2
Fed	Position in the public power hierarchy: Fed = 1 if the organization operates at the federal level, zero otherwise (regional or municipal).	275	0.08	Q2
Reg	Position in the public power hierarchy: Reg = 1 if the organization operates at the regional level, zero otherwise (federal or municipal).	275	0.10	Q2
Mun	Position in the public power hierarchy: Mun = 1 if the organization operates at the municipal level, zero otherwise (regional or federal).	275	0.34	Q2
PP_dep	Procurement department: PP_dep = 1 if the organization has a dedicated purchasing department (service), zero otherwise.	262	0.61	Q4
LARGE	Large annual volume of procurement: Large = 1 if the organization’s purchases in the current year exceed 10 million rubles, zero otherwise.	247	0.51	Q5
STRAT	Procurement strategy: Strategy = 1 if the organization has an established strategy, zero otherwise.	223	0.57	Q7
<b>Information factors</b>				
STNDS	Using existing standards for environmental criteria: Standards = 1 if the organization is reported to use federal or regional environmental standards as reference when formulating environmental criteria in procurement, otherwise zero (this	275	0.24	Q13

**Table 1 (continued)**

Variable	Description	$N_{resp}$	Mean	Question
	includes information from the internet, ecolabelling standards, information from suppliers, consulting, etc., as well as the option “we don’t use environmental criteria in procurement”)			
EAS	Environmental Awareness Skills: EAS = 1 if respondent reports to have sufficient skills to set and assess environmental criteria and standards, zero otherwise.	223	0.06	Q15
Model_crit	Need in model environmental criteria: Model_crit = 1 if the respondent agrees there is a need in model environmental criteria for goods and services, zero otherwise.	223	0.86	Q16

methodology, controlling for other available characteristics of the organization, minimizes the sampling error.

The *nonresponse error* may arise if organizations that were invited but did not take part in the survey, systematically differ (in a research relevant aspect) from those who agreed to take part in the survey. In our sample, nonresponses are to a large extent due to partner institutions (training centers and regional sections of the Guild) not forwarding our invitations further, i.e., are exogenous to the organization. Instances of endogenous nonresponse, i.e., when participants started the survey, learnt about the topic and decided to quit, are under 20% (52 out of 275). While their fraction is relatively low and should not substantially affect the result, assume the organization type in the above sense is augmented with the endogenous response/nonresponse classifier. Managers who find the topic of sustainable procurement important, would be more likely to complete the questionnaire, hence we would expect a higher degree of pro-environmentalism in their firms and their responses. First, this aligns with our objective to detect intrinsic motivation for pro-environmental behavior. Second, with this self-selection, our estimates of the degree to which organizations adopt environmental criteria in procurement, may have an upward bias. If in this sample with higher pro-environmental attitudes we detect significant non-adoption and/or an impact of the type of the law on the non-adoption of environmental criteria in procurement, results would extend and be stronger in the overall sample with weaker pro-environmentalism. The direction of the potential non-response error thus strengthens our results. Other types of *selection errors*, such as surveying respondents who are unaware of procurement practices in their organization, are ruled out by the sample collection procedure as we sought responses from suitably qualified participants. We address and quantify the potential non-response error in Section 4.2. In doing so, we additionally use data from a new survey conducted in December 2021, covering 1395 respondents in total, where we can use the difference between responses obtained after the first contact, and those obtained after a reminder, to test for the directionality of the potential non-response bias. Our tests detect no significant non-response bias in this type of surveys.

To ensure robustness of results, we complement our analysis with data on about 250,000 procurement procedures from the official public procurement database, see Section 4.3. While using official statistics offers a larger and more representative sample, it lacks micro-level specifications for organizations, which are an important advantage of the survey data we use for the major part of the paper. In brief, all key results stand, confirming the validity of conclusions made on the survey sample.

### 3.3. Variables

Survey responses were converted to binary variables as described below. For all first-order constructs (variables) the Cronbach alpha is at

least 0.7, speaking in favor of the reliability of the questionnaire. All variables, their brief descriptions and descriptive statistics are summarized in Table 1. Column “Question” indicates which question was used to construct the variable, see the full questionnaire in Appendix B.

Our dependent variables are ECO (for Organizations that use Environmental Criteria), RepECO (repeated usage of Environmental Criteria by the Organization) and LCC (Life-Cycle Cost used by organization). We assign  $ECO = 1$  if the response to the question “Which criteria does your organization use in procurement?” includes at least one environmental criterion, and zero if the response was “none” (or any similar wording in the free text field “other”);  $RepECO = 1$  if the response to the question “How often does your organization apply environmental criteria in procurement?” is between “rare” and “always” (the wording of the question makes this range correspond to 10%–100% of all procedures per year), and zero otherwise;  $LCC = 1$  if the organization is reported to apply the life-cycle cost criterion in procurement (answers “yes” or “sometimes”), and zero – if the answer was “no” (responses with an answer “I don’t know” were classified as missing). These three variables capture different levels of expected cost associated with three types of procurement behavior: the occasional usage of environmental criteria is the least costly and is captured by ECO but not the other two variables, the regular usage of eco-criteria is a more costly option, captured by RepECO, and finally the most complicated and costly is the option of using life-cycle cost criteria (LCC). As a complement to ECO, we also consider a stricter variable ECO<sub>noEN</sub>, capturing using environmental criteria of any type but the energy efficiency.

The next group of variables captures the institutional setting. For the law that regulates the procurement activity of the organization, we assign  $RigidLaw = 1$  if the organization is reported as “municipal”, “regional” or “federal authority” – these organizations are governed by 44FZ only; otherwise  $RigidLaw$  is assigned value 0. We also create binary variables  $Mun$ ,  $Reg$ ,  $Fed$ , which take value 1 if the organization is a municipal, regional, or federal authority respectively. This provides a finer view on the type of contracting authority within the 44FZ. As some organizations fall under both laws, we also create the variable  $FlexLaw$ , which takes the value “1” if the organization works only under 223FZ, or “0” if it falls under both 223FZ and 44FZ.<sup>9</sup> Since the two laws cover organizations of different types (public authorities versus publicly funded organizations), this further distinction between organization types is necessary to distinguish between the law effect (the difference between the two large groups of organizations given by  $RigidLaw$ ) and the type of organization effect; the latter will be studied within the subsample governed by one law.

Further three variables describe the organizational features. We assign  $LARGE = 1$  if the organization is reported to spend more than RUR 10 m per year around the survey time.<sup>10</sup> Variable  $PP\_dep$  takes value 1 if the organization is reported to have a dedicated procurement department (service), otherwise – “0”. Variable  $STRAT$  takes a value of “1” if the organization has an established procurement strategy, otherwise – “0” (this would include, in particular, organizations that might use environmental criteria but have no formal procurement strategy).

Finally, we turn more explicitly to the “caution” factor, which plays a role when organizations are unable to decide what is the right way to apply environmental criteria. To capture this lack of information, we construct relevant variables from the survey questions. First, although the procurement regulation specifies nothing with respect to environmental criteria, there exist ecological standards in other areas, for example, for various types of manufactured goods. These do not directly apply to public procurement, but the relevant provisions of the related

legislation may be used by contracting authorities for formalization of environmental criteria.<sup>11</sup> We therefore use the question “Where do you find information needed to formulate environmental criteria/requirements in procurement” to construct binary variable  $STNDS$  to reflect the usage of this related legislation by organizations. We assign  $STNDS = 1$  if the answer includes options “a federal standard on environmental issues” or “a regional standard on environmental issues”, otherwise zero. We interpret  $STNDS = 1$  as a higher level of awareness and a lower level of uncertainty with respect to using legally acceptable (defendable) environmental criteria, and thus a lower “caution” factor.

Second, we compute variable  $EAS$  (Environmental Awareness Skills<sup>12</sup>) from the question “Do you think your skills suffice to set and assess various environmental criteria/standards?” We assign  $EAS = 1$  for respondents who answer “yes”, and zero otherwise. We interpret this variable as the respondent’s confidence in application of environmental criteria. As the respondent is a person responsible for procurement in the relevant organization, we deem the caution factor to be lower for organizations with  $EAS = 1$  than for organizations with  $EAS = 0$ .

Third, we employ question “Do you believe there is a need in model environmental criteria for goods and services?” to construct variable  $Model\_crit$ , which takes value  $Model\_crit = 1$  if respondents choose “yes, they should be developed and approved by the state” or “yes, they should be developed by non-governmental organizations active in the area of environmental protection”. If respondents choose one of the other two options (“there is no need in them” or “I cannot answer this question”) we assign  $Model\_crit = 0$ . We interpret  $Model\_crit = 1$  as an indicator of knowledge and skills that allow respondents to recognize the need in such model criteria.

### 3.4. Estimation approach

We designate our binary variables indicating whether respondents ever used eco-criteria

( $ECO = 1$ ), repeatedly used them ( $RepECO = 1$ ), and whether they ever used the life-cycle cost criteria ( $LCC = 1$ ), as a dependent variable  $Y_i$  (for each organization  $i$ ) in the following probit regression:

$$F(Y_i) = \alpha RigidLaw_i + \beta Z_i + \varepsilon_i, \quad (1)$$

where  $RigidLaw_i$  denotes whether procurement in organization  $i$  is governed exclusively by the more rigid law 44FZ ( $RigidLaw_i = 1$ ) or by 223FZ or both ( $RigidLaw_i = 0$ ). As discussed in Section 3,  $\alpha < 0$  would indicate that the “caution” factor overweighs the implicit incentive effect (“pro-environmentalism”), while  $\alpha > 0$  would indicate the opposite. In all regressions vector  $Z_i$  groups control variables,  $F$  is the inverse normal distribution function, and  $\varepsilon_i$  is the error term, as usual.

To further distinguish between the “caution” and the “pro-environmentalism” factors, we consider an analogue of regression (1) on subsamples  $RigidLaw_i = 1$  and  $RigidLaw_i = 0$  separately:

$$F(Y_i) = \alpha X_i + \beta Z_i + \varepsilon_i, \quad (2)$$

<sup>11</sup> Indirectly, 44FZ explicitly requires product labelling should meet the requirements of the national standardization system. Examples include GOST R 51870–2014 “Cleaning services. General technical conditions”, Sanitary Norms 2.1.4.1116–02 “Drinking water. Hygienical requirements for bottled water quality. Quality control”, Sanitary Norms 2.3.2.1078–01 “Food commodities and food products. Hygienical requirements for safety and nutritional value of food. Sanitary-epidemiological rules and norms”, and others.

<sup>12</sup> The EU Skills Panorama defines Environmental Awareness Skills as “the knowledge, abilities, values and attitudes [in the general population] needed to live in, develop and support a society which reduces the impact of human activity on the environment. These generic ‘green’ skills include the capacity to include environmental concerns alongside others (such as performance and safety) in taking decisions, including in the choice of processes and technologies.” (<https://skillspanorama.cedefop.europa.eu/en/content/environmental-awareness-skills>).

<sup>9</sup> Two respondents answered “other” with a clarification “a company with a state participation” – we classified them as 223FZ.

<sup>10</sup> The CPI inflation in Russia was at its historical minimum of 2.5% in 2017, and at 4.2% in 2018, hence the definition of a “large” organization is largely unaffected in these two years.

In these subsamples, we measure the institutional impact by the level of authority ( $X_i = \text{Mun}_i$ ) in the subsample of organizations governed exclusively by 44FZ, and by the subordination to the single or to both legislations ( $X_i = \text{FlexLaw}_i$ ) in the remainder. If the pro-environmentalism and the expertise that counteracts the “caution” factor dominate, we expect  $\alpha < 0$  in the subsample operating exclusively under 44FZ, as municipal authorities are to a lesser degree associated with the Federal government and may have less experienced staff.

In the subsample of organizations not exclusively governed by 44FZ,  $\text{RigidLaw}_i = 0$ , organizations that are governed by both 223FZ and 44FZ experience a “spillover” effect in terms of the “caution” factor, hence if this factor is non-nil, we should observe  $\alpha > 0$  as  $\text{FlexLaw}_i = 1$  indicates companies that are free from this spillover. This estimate isolates the caution factor.

The effect of variables in  $Z_i$  can be obtained from the estimate of (Aragon-Correa et al., 2020). For robustness, we first run (Aragon-Correa et al., 2020) without the law variable ( $\alpha = 0$ ) and then complement the subsample analysis (Armstrong and Overton, 1977) by running regressions with interactions:

$$F(Y_i) = \alpha X_i + \beta Z_i + \gamma X_i \times Z_i + \varepsilon_i, \quad (3)$$

where  $Z_i$  denotes an element of  $Z_i$ .

All estimations are by maximum likelihood (Stata/MP vers. 16.1).

### 3.5. Endogeneity

Two main types of endogeneity may be suspected: (Aragon-Correa et al., 2020) based on external shocks (if our regressor is correlated with unobservable factors) and (Armstrong and Overton, 1977) simultaneous endogeneity (when there is interdependence between explanatory and explained variables). We detect no high (strong) significant correlation between regressors and dependent variables (see Appendix C), which means that there is no simultaneous endogeneity in the models.<sup>13</sup> As for the first type of endogeneity in our independent variables, our key explanatory variables are institutional (a priori exogenous). However, the organizational characteristics that are reported by individual respondents can be affected by some unobserved factors. To test if organizational characteristics EAS, STNDS and Model\_crit are endogenous, we employ the test of exogeneity for a probit model proposed by Smith and Blundell (1986). The test involves specifying that the exogeneity of one or more explanatory variables is suspected. Under the null hypothesis, the models are appropriately specified with all explanatory variables as exogenous. Under the alternative hypothesis, the suspected endogenous variables are expressed as linear projections of a set of instruments, that we have created from the same set of variables, and the residuals from those first-stage regressions are added to the model. For the IV's we used the existing variables in our data (i.e., we use STNDS as the IV for EAS and Model\_crit as the IV for STNDS and vice versa). Conventionally, there is no need to check the relevance of IV's because the Smith-Blundell method estimates the exogeneity of a specified regressor (not of the IV's like in the Sargan's test for the need of over-identifying restrictions). Results (Appendix C) reject endogeneity in our non-institutional variables. The Smith-Blundell test was made for all specifications of regressions (i.e., for 4 models: ECO, ECO<sub>noEN</sub>, RepECO, LCC) and is robust to the change of the explained variable.

<sup>13</sup> The only correlation that classifies variables as highly dependent (Mukaka, 2012) is between ECO and ECO<sub>noEN</sub> ( $\rho = 0.6$ ). We have no model that contains both these variables simultaneously.

## 4. Results

### 4.1. Main results

Our discussion in Section 2 implies the institutional context affects pro-environmental behavior of organizations, in particular we expect a difference in the usage of environmental criteria by organizations regulated by the law 44FZ (variable “RigidLaw”) and by the more flexible framework law 223FZ. Fig. 2 shows the proportions of organizations that have ever applied at least one environmental criterion (ECO = 1), organizations that apply them repeatedly (RepECO = 1) and organizations who ever used an LCC-criterion in the procurement process (LCC = 1) in relevant legislation subsamples (organizations falling under both laws are included in the group 223FZ). For all the three variables, there is a significant (at least at  $p < 0.05$ ) difference between organizations subject to different regulations: those governed by a more rigid law are less likely to adopt pro-environmental measures in procurement. We can interpret this as causality from the law to the environmental criteria because the type of the law is exogenous to organizations, hence causality cannot run from the environmental decisions made to the type of the law that governs the procurement process.

Fig. 2 delivers the first and rather unsurprising prediction: the fraction of institutions that implement environmental principles in procurement is significantly above zero, ranging from over 65% for the least costly ECO criterion to just about 25% for the more costly LCC criterion. Yet the impact of the law is in stark contrast with the idea that being part of the government (regulated by 44FZ) should lead to a greater alignment of the organization's behavior with the declared priority of the state. Comparison of the average usage of environmental criteria for organizations regulated by 44FZ versus those under 223FZ, suggests that the pro-environmental inclination of public bodies under the former is offset by caution, which we associate with the rigidity of the law.

The difference-in-means analysis in Fig. 2 does not account for the potential heterogeneity of subsamples. To elaborate, Table 2 provides estimates of Eq. (1) for all the three dependents, controlling for the existence of the dedicated procurement department (PP\_dep), the large volume of purchases (LARGE), the procurement strategy (STRAT), the organizations' knowledge from official standards (STNDS), the environmental awareness skills of the respondent (EAS), and the perceived need in model environmental criteria (Model\_crit). Columns (Armstrong and Overton, 1977), (Bouwer et al., 2006) and (Casson et al., 2010) in Table 2 estimate the impact of the variable *RigidLaw* on the three measures of pro-environmental behavior. Results indicate the usage of environmental criteria (ECO) is by 12.5% lower and the usage of the LCC criterion by almost 10% lower among organizations working under the rigid law 44FZ (for repeated usage of environmental criteria the difference, once controlled for other factors, is still in the same direction

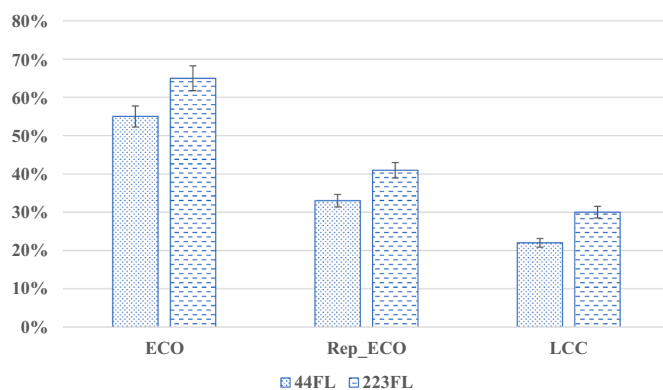


Fig. 2. Percentage of organizations that applied eco-criteria in procurement, in the total number of organizations under 44FL and 223FL (with confidence intervals for  $p = 0.05$ ).

**Table 2**  
Factors affecting the application of environmental criteria in procurement under 44FZ and 223FZ.

Dependent	ECO		RepECO		LCC	
	(1)	(2)	(3)	(4)	(5)	(6)
RigidLaw	–	–0.124** (0.0594)	–	–0.0796 (0.0573)	–	–0.094* (0.0561)
PP_dep	0.0575 (0.0598)	0.0177 (0.0641)	0.0636 (0.0639)	0.0226 (0.0666)	0.0460 (0.0607)	0.0287 (0.0621)
LARGE	0.0839 (0.0578)	0.0599 (0.0592)	0.0665 (0.0627)	0.0659 (0.0623)	0.0609 (0.0593)	0.0860 (0.0575)
STRAT	0.105* (0.0556)	0.0997* (0.0552)	0.0572 (0.0607)	0.0466 (0.0602)	0.0518 (0.0571)	0.0585 (0.0570)
STNDS	0.276*** (0.0766)	0.234*** (0.0618)	0.327*** (0.0640)	0.331*** (0.0630)	0.230*** (0.0623)	0.282*** (0.0762)
EAS	0.195 (0.142)	0.203 (0.125)	0.211* (0.128)	0.282*** (0.109)	0.287*** (0.111)	0.188 (0.140)
Model_crit	0.174*** (0.0556)	0.171*** (0.0608)	0.151** (0.0615)	0.153** (0.0655)	0.188*** (0.0568)	0.0759 (0.0604)
Pseudo_R2	0.1178	0.1223	0.1148	0.1172	0.1187	0.1193
Prob > chi2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0001
AIC	261.5	262.2364	275.5284	276.8078	235.5219	237.3527
BIC	285.3502	289.4938	299.3786	304.0651	259.3721	264.6101
Obs.	223	223	223	223	223	223

Notes: Probit regressions, average marginal effects. Dependent variables “ECO” (column 1 and 2) and “Rep\_ECO” (column 3 and 4) and “LCC” (column 5 and 6). Statistical significance levels: 1% (\*\*\*), 5% (\*\*) and 10% (\*). Standard errors in parentheses. Main regression statistics Pseudo\_R2, likelihood ratio chi-square, AIC, and BIC from probit estimation.

but lacks statistical significance). Recall from Table 1, the mean of ECO is 67% and the mean of LCC is just 25% in the sample, indicating the rigidity of the law leads to an economically significant variation in the usage of environmental criteria in procurement.

Running the same regressions without RigidLaw (columns 1, 3 and 5 in Table 2) does not substantially alter the effect of control factors on pro-environmental decisions: factors that affect decisions to follow environmental principles in procurement are almost exclusively related to information. The most prominent among them is the usage of information on environmental criteria from existing technical standards – if the procurement staff of the organization recognizes this possibility, or the nature of the products and services acquired allows for usage of those standardized criteria, the likelihood of having pro-environmental procurement procedures increases by about 25–30%, for all the three measures of environmental friendliness. This is in line with our discussion of caution in the procedure choice as arising from uncertainty that surrounds the application of the law: reducing this uncertainty reduces the barrier to environmental procurement.

For a deeper insight with respect to the impact of implicit incentives towards pro-environmentalism, we test whether within the organizations governed by 44FZ the closeness to the government makes a difference. For this purpose, we estimate Eq. (2) with  $X = Mun$  on a subsample of organizations subordinate to 44FZ, for each of the three dependents, see Table 3. The main finding is the significant reduction in the likelihood three out of four types of pro-environmental behavior for municipal authorities, as compared with their regional and federal counterparts. Again, this may be due to stronger implicit pro-environmental incentives for federal and regional governmental agencies (who might wish to align with the government objective, or due to their ability to overcome the implications of legal uncertainty. For ECONoEN the effect of being a local government is still negative though lacks statistical significance – this dependent variable captures criteria that arguably require more expertise in applying them than the rather standard energy efficiency. Once it is about more difficult choices, the difference between different levels of power vanishes. Note the significance of the two out of three information factors.

To isolate the caution factor, we now focus on the subsample of respondents who are to a lesser degree affected by considerations of aligning with the government’s priorities: organizations in the subsample RigidLaw = 0 do not form part of the government. We thus estimate Eq. (2) for this subsample with the institutional factor  $X =$

**Table 3**  
Factors affecting the application of environmental criteria by organizations covered exclusively by 44FZ.

Dependent	ECO	ECONoEN	RepECO	LCC
	(1)	(2)	(3)	(4)
Mun	–0.222** (0.0890)	–0.0901 (0.0952)	–0.237** (0.0844)	–0.226** (0.0854)
PP_dep	0.0123 (0.0869)	–0.107 (0.0922)	–0.139 (0.0856)	0.00104 (0.0888)
LARGE	0.000449 (0.0844)	–0.0400 (0.0902)	0.0117 (0.0845)	0.0158 (0.0857)
STRAT	0.0427 (0.0835)	–0.117 (0.0866)	0.122 (0.0814)	–0.0607 (0.0834)
STNDS	0.241** (0.104)	0.267*** (0.0961)	0.264*** (0.0875)	0.267*** (0.0843)
EAS	0.155 (0.201)	0.107 (0.185)	0.167 (0.165)	0.190 (0.163)
Model_crit	0.211** (0.107)	0.0987 (0.116)	0.221** (0.115)	0.231** (0.126)
Pseudo_R2	0.0986	0.0786	0.1094	0.0999
Prob > chi2	0.0183	0.0483	0.0106	0.0348
AIC	153.5377	162.718	149.7472	136.3313
BIC	172.9325	182.1128	169.142	155.7261
Obs.	118	118	118	118

Notes: Probit regressions, average marginal effects. Dependent variables “ECO” (column 1), “ECONoEN” (column 2) “Rep\_ECO” (column 3) and “LCC” (column 4). Statistical significance levels: 1% (\*\*\*), 5% (\*\*) and 10% (\*). Standard errors in parentheses. Main regression statistics Pseudo\_R2, likelihood ratio chi-square, AIC, and BIC from probit estimation.

FlexLaw, this separates organizations that act solely under the 223FZ from those that are also subject to the stricter 44FZ. Results are in Table 4: organizations falling solely under 223FZ are more likely to implement eco-criteria than those that are also subject to the more rigid 44FZ. The result is likely due to the caution in the selection of procedures: organizations that work under both legislations, are overprotecting themselves by selecting more standard procedures and criteria that could not potentially violate the strict requirements of 44FZ. As in Table 3, using a “more difficult” set of criteria captured by ECONoEN is statistically unaffected by the type of the law or the information factors.

To shed more light on the caution-based explanation, we draw attention to the information factors and estimate Eq. (3) with interaction terms. If caution indeed plays a significant role, the interaction between



**Table 4**  
Factors affecting the application of environmental criteria by organizations covered exclusively by 223FZ.

	ECO	ECO <sub>noEN</sub>	RepECO	LCC
	(1)	(2)	(3)	(4)
FlexLaw	0.281*** (0.073)	-0.0184 (0.101)	0.137* (0.091)	0.471*** (0.241)
PP_dep	0.0605 (0.0844)	-0.0264 (0.103)	0.102 (0.0957)	0.0583 (0.0863)
LARGE	0.14* (0.0702)	-0.0157 (0.0990)	0.157* (0.0903)	0.135* (0.0801)
STRAT	0.130* (0.0725)	0.0185 (0.0954)	0.151* (0.0925)	0.123* (0.0625)
STNDS	0.234** (0.117)	0.174 (0.116)	0.400*** (0.0938)	0.329*** (0.0787)
EAS	0.149 (0.193)	0.271 (0.202)	0.179 (0.182)	0.363** (0.142)
Model_crit	0.351** (0.123)	-0.0477 (0.0950)	0.155* (0.0912)	0.192*** (0.0734)
Pseudo_R2	0.1659	0.0618	0.1600	0.2065
Prob > chi2	0.0022	0.1752	0.0009	0.0006
AIC	117.2197	150.1227	133.3693	105.4642
BIC	135.7974	168.7004	151.947	124.042
Obs.	105	105	105	105

Notes: Probit regressions, average marginal effects. Dependent variables “ECO” (column 1), “ECO<sub>noEN</sub>” (column 2) “RepECO” (column 3) and “LCC” (column 4). Statistical significance levels: 1% (\*\*\*), 5% (\*\*) and 10% (\*). Standard errors in parentheses. Main regression statistics Pseudo\_R2, likelihood ratio chi-square, AIC, and BIC from probit estimation.

the law and the information factors should be strictly positive: better informed organizations should be able to counteract the negative effect of the law. Table 5 reveals the interaction is zero for the STNDS and the EAS factors: the former describes the ability of contracting authorities to find the relevant information in the technical standards available, and the latter describes their environmental awareness. However, the

**Table 5**  
Interacted effects of rigid legislation on usage of environmental criteria.

Dependent = ECO	(1)	(2)	(3)	(4)	(5)	(6)
RigidLaw	-0.278*** (0.0910)	-0.220*** (0.0722)	-0.157** (0.0757)	-0.0576 (0.0654)	-0.0807 (0.0596)	-0.500*** (0.155)
PP_dep	0.167** (0.0812)	0.00109 (0.0629)	0.0137 (0.0638)	0.0153 (0.0640)	0.0174 (0.0643)	0.0170 (0.0634)
LARGE	0.0477 (0.0581)	0.211*** (0.0763)	0.0426 (0.0599)	0.0639 (0.0593)	0.0600 (0.0593)	0.0399 (0.0577)
STRAT	0.0475 (0.0561)	0.0273 (0.0567)	0.133* (0.0740)	0.0612 (0.0570)	0.0583 (0.0571)	0.0371 (0.0554)
STNDS	0.216*** (0.0608)	0.235*** (0.0597)	0.236*** (0.0609)	0.282*** (0.0924)	0.233*** (0.0620)	0.232*** (0.0580)
EAS	0.293*** (0.105)	0.270*** (0.104)	0.283*** (0.107)	0.285*** (0.109)	0.273* (0.160)	0.287*** (0.105)
Model_crit	0.0962 (0.0648)	0.117* (0.0620)	0.131** (0.0642)	0.169*** (0.0619)	0.159*** (0.0611)	0.246*** (0.0621)
RigidLaw × PP_dep	0.340*** (0.118)					
RigidLaw × LARGE		0.311*** (0.104)				
RigidLaw × STRAT			0.161 (0.105)			
RigidLaw × STNDS				-0.0887 (0.128)		
RigidLaw × EAS					0.0161 (0.222)	
RigidLaw × Model_crit						0.515*** (0.164)
Pseudo_R2	0.1224	0.1270	0.1301	0.1223	0.1223	0.1224
Prob > chi2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
AIC	264.2045	262.9006	262.049	264.2244	264.2245	264.1968
BIC	294.869	293.5651	292.7136	294.8889	294.8891	294.8614
Obs.	223	223	223	223	223	223

Notes: Probit regressions, average marginal effects. Dependent “ECO”. Statistical significance levels: 1% (\*\*\*), 5% (\*\*) and 10% (\*). Standard errors in parentheses. Main regression statistics Pseudo\_R2, likelihood ratio chi-square, AIC, and BIC from probit estimation.

interaction of Model\_crit with the type of the law has a highly significant positive effect: if respondents recognize there is a need in model criteria, which can only happen if they do search for information and have some experience in applying that information to design pro-environmental procurement procedures, they are more likely to overcome the negative effect of the strict 44FZ.

Tables 6 and 7 estimate the same for the other two dependent variables. Once we focus on more sophisticated measures of green procurement, the effect of information becomes statistically insignificant. Indeed, if an organization repeatedly uses environmental criteria in procurement, or if it applies the LCC assessment, it already demonstrates awareness and expertise, for which reason also the impact of the rigid law is less pronounced, as we saw in Table 2 (columns 4 and 6). These results suggest information and expertise indeed play a significant role in reducing the earlier detected effect of rigid regulation.

#### 4.2. Assessment of the non-response bias

As discussed in Section 3.2, data may be prone to a non-response bias. First, we follow Fousteris et al. (2018) and apply the method of Armstrong and Overton (1977): the method tests differences between the first and the last 25% questionnaires using the Mann–Whitney test (U test). We use the non-parametric U test for the sample comparison, because the distributions in subsamples are not normal and the sizes of resulting subsamples are relatively small. In our survey sample 93 responses were submitted using an online platform (SurveyMonkey) between April 2017 to September 2017, offering an opportunity to compare early and late submissions. We took the first and the last 23 observations and compared distributions of our main variables ECO, ECO<sub>noEN</sub>, RepECO, LCC, RigidLaw using a U test. The test did not reveal statistically significant differences ( $p > 0.1$ ) for the above variables, suggesting the nonresponse bias in our sample is insignificant.

To get a further insight in the directionality of the non-response bias,

**Table 6**  
Interacted effects of rigid legislation on repeated usage of environmental criteria in procurement.

Dependent = RepECO	(1)	(2)	(3)	(4)	(5)	(6)
RigidLaw	-0.0781 (0.0937)	-0.219*** (0.0777)	-0.226*** (0.0807)	-0.119* (0.0666)	-0.130** (0.0613)	-0.243* (0.130)
PP_dep	0.0138 (0.0875)	0.00832 (0.0667)	0.0170 (0.0666)	0.0219 (0.0667)	0.0207 (0.0668)	0.0126 (0.0673)
LARGE	0.0698 (0.0625)	0.166** (0.0821)	0.0471 (0.0629)	0.0668 (0.0625)	0.0662 (0.0623)	0.0592 (0.0625)
STRAT	0.0443 (0.0603)	0.0641 (0.0603)	-0.0458 (0.0791)	0.0456 (0.0604)	0.0476 (0.0603)	0.0546 (0.0603)
STNDS	0.335*** (0.0631)	0.332*** (0.0622)	0.333*** (0.0621)	0.347*** (0.103)	0.330*** (0.0631)	0.329*** (0.0623)
EAS	0.200 (0.126)	0.197 (0.123)	0.204* (0.123)	0.204 (0.125)	0.156 (0.180)	0.202 (0.124)
Model_crit	0.120* (0.0688)	0.0772 (0.0674)	0.0673 (0.0690)	0.108 (0.0666)	0.104 (0.0657)	0.136* (0.0710)
RigidLaw × PP_dep	-0.0804 (0.125)					
RigidLaw × LARGE		0.208* (0.114)				
RigidLaw × STRAT			0.201* (0.111)			
RigidLaw × STNDS				-0.0275 (0.144)		
RigidLaw × EAS					0.0906 (0.249)	
RigidLaw × Model_crit						0.150 (0.146)
Pseudo_R2	0.1261	0.1189	0.1174	0.1187	0.1173	0.1244
Prob > chi2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
AIC	276.1707	278.3071	278.7506	278.3576	278.7972	276.671
BIC	306.8353	308.9717	309.4151	309.0222	309.4618	307.3356
Obs.	223	223	223	223	223	223

Note: Dependent = RepECO. Probit regressions, average marginal effects (AME). Standard errors in parentheses. \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . Main regression statistics Pseudo\_R2, likelihood ratio chi-square, AIC, and BIC from probit estimation.

**Table 7**  
Interacted effects of rigid legislation on usage of Life-Cycle-Cost assessment in procurement.

Dependent = LCC	(1)	(2)	(3)	(4)	(5)	(6)
RigidLaw	-0.131 (0.0835)	-0.0660 (0.0729)	-0.0620 (0.0738)	-0.0998* (0.0597)	-0.0969* (0.0573)	-0.159 (0.112)
PP_dep	0.0626 (0.0848)	0.0327 (0.0624)	0.0295 (0.0620)	0.0293 (0.0620)	0.0277 (0.0622)	0.0228 (0.0626)
LARGE	0.0894 (0.0577)	0.121 (0.0809)	0.0781 (0.0587)	0.0869 (0.0575)	0.0856 (0.0575)	0.0901 (0.0576)
STRAT	0.101* (0.0552)	0.0932* (0.0563)	0.134* (0.0752)	0.100* (0.0553)	0.0999* (0.0552)	0.104* (0.0554)
STNDS	0.280*** (0.0763)	0.280*** (0.0760)	0.281*** (0.0763)	0.255** (0.127)	0.282*** (0.0762)	0.282*** (0.0758)
EAS	0.190 (0.140)	0.190 (0.141)	0.188 (0.141)	0.187 (0.140)	0.154 (0.205)	0.188 (0.140)
Model_crit	0.0889 (0.0643)	0.0675 (0.0620)	0.0637 (0.0631)	0.0786 (0.0612)	0.0768 (0.0606)	0.0561 (0.0673)
RigidLaw × PP_dep	0.0674 (0.115)					
RigidLaw × LARGE		-0.0673 (0.110)				
RigidLaw × STRAT			-0.0714 (0.105)			
RigidLaw × STNDS				0.0438 (0.163)		
RigidLaw × EAS					0.0620 (0.279)	
RigidLaw × Model_crit						0.0849 (0.128)
Pseudo_R2	0.1301	0.1255	0.1248	0.1295	0.1198	0.1193
Prob > chi2	0.0001	0.0001	0.0001	0.0001	0.0002	0.0002
AIC	236.6411	237.8031	237.9907	236.8094	239.2461	239.3526
BIC	267.3056	268.4677	268.6553	267.4739	269.9106	270.0172
Obs.	223	223	223	223	223	223

Note: Dependent = LCC. Probit regressions, average marginal effects (AME). Standard errors in parentheses \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . Main regression statistics Pseudo\_R2, likelihood ratio chi-square, AIC, and BIC from probit estimation.

we make use of the newly collected data from another survey we administered in December 2021. While the overall objective of this new survey is different, we can construct our key variables (as in Table 2) and use the variation in the invitation waves to estimate the non-response bias (similarly to Bollinger and Hirsch, 2013, and Heffetz and Rabin, 2013). Specifically, we construct a new variable *NonResp* which takes a value of 0 if the response was provided after the first invitation wave, and a value of 1 if the response was provided after a reminder. Variable *ECO* is constructed from the question “What would be your estimate of the share of ecological procedures in the total annual volume of procurement?” We assigned  $ECO = 0$  if respondents choose “we have no ecological procedures” and  $ECO = 1$  if they indicate any strictly positive percentage. Variable *RepECO* is constructed from a series of questions “Which of the following criteria are applied in procurement procedures in your organization?”: if respondent  $i$  chose “often” or “almost always” for at least one out of eight ecological criteria given, we assign  $RepECO_i = 1$ , otherwise we assign a value of zero if all of these criteria are used rarely, almost never or never. Variable *LCC* is assigned a value of 1 for respondents who indicated the criterion of life-cycle costing was used at least rarely, and zero if never. In all cases, responses “I don’t know” and “prefer not to answer” are treated as missing.

For a deeper analysis of the potential bias, we conduct a regression analysis on the new data, similar to that reported in Table 2. Our key independent variable *RigidLaw* obtains from the type of the organization reported in the new survey (it takes a value of 1 for federal, regional or municipal authorities, and zero otherwise). Finally, the new survey also offers two control variables *LARGE* and *STNDS*, which are identical in their definition to those used in Table 2 and throughout Section 4.1. With this new data, we now estimate an extended version of (Aragon-Correa et al., 2020), with and without an additional control for *NonResp* and its interaction with *RigidLaw*:

$$F(Y_i) = \alpha RigidLaw_i + \beta_{NR} NonResp_i + \gamma_{NR} RigidLaw_i \times NonResp_i + \beta Z_i + \varepsilon_i. \quad (4)$$

Estimating (Bouwer et al., 2006) with  $\beta_{NR} = 0$  and  $\gamma_{NR} = 0$  offers a robustness check of our results on the newly obtained data (we expect  $\alpha$  to have the same sign as the coefficient for *RigidLaw* in Table 2). The sign and significance of  $\beta_{NR}$  in the specification with  $\gamma_{NR} = 0$  indicates the non-response bias in the data, while the sign and significance of  $\gamma_{NR}$  in the specification with the interaction term allows us to judge on the non-response bias in the estimated effect of *RigidLaw* on the set of our dependent variables. Results are in Table 8: in the newly collected data, the type of the law has the same negative effect on the application of environmental criteria, confirming our main result. Non-response does not significantly affect the distribution of responses for *ECO* and *RepECO*; the only significant term, at  $p < 0.1$ , appears for the *LCC* criterion, where the negative sign of the coefficient is in line with our reasoning in Section 3.2: organizations that are less likely to respond, are also less likely to apply the *LCC* criterion in procurement.<sup>14</sup> Finally, all interaction terms are insignificant, indicating that our main result, i.e. the negative effect of the rigidity of the law, is free of the non-response bias.

#### 4.3. Robustness check

Do our results hold out of sample? For cross-validation, we collect a random sample of procurement procedures completed in 2017–18 from the Russian Unified Information System (RUIS), which pools together

<sup>14</sup> We also estimated the same regressions for *EcoNoEn* as a dependent, which was constructed from the same questions as *RepECO*, with  $EcoNoEn = 1$  for respondents who indicated using any of the non-energy criteria at least rarely, and zero for those who reported them to be used never or almost never. Results for estimates with *EcoNoEn* mimic those for *RepECO* and are therefore not reported, for compactness.

data on all public procurement procedures in the country. We do this by downloading 10,000 procedures (the maximum that the system delivers in response to one search request; if the total number of procedures requested exceeds this maximum, the system returns 10,000 randomly selected procedures that meet the search request; randomization is uniform over all procedures meeting the search criteria) for each of the 85 regions of Russia (hence, our search criteria were the time period and the region). The resulting sample of 850 thousand procedures represents roughly one tenth of the total number of procedures in the country over the 2 years. To ensure representativeness, we further stratify this sample by randomly selecting from each region’s subsample the number of procedures proportional to the share of this region in the total number of procedures in the country over these 2 years. For example, Moscow has the highest number of procedures across all regions (10.1% share), we assign Moscow a weight of 1.0 and include all downloaded 10,000 procedures in our sample. Moscow Region and St Petersburg have shares of 4.73% and 4.92% respectively, they receive the respective weights  $4.73/10.1 = 46.83\%$  and  $4.92/10.1 = 48.71\%$ , which is the percentage of procedures we randomly select from their regional samples. We proceed like this for all 85 regions. The resulting representative sample consists of 98,943 procedures, which is about 1% of the overall number of procedures over 2 years (the resulting sample is much smaller because many regions contribute less than 5% to the overall procurement activity in the country). We label this sample RUIS-S (S for “stratified”).

This RUIS-S sample contains 53,428 procedures (54%) under 44FZ, which compares well with the 52% split in our survey sample. For each procedure we identified the type of the procuring body, in total 15,506 organizations, of which 8837 under 44FZ and 6669 under 223FZ or both. Among the former we have 5090 (57.5%) organizations at the municipal, 2063 (23.5%) at the regional and 1684 (19%) – at the federal level. As for the remainder, 2474 are corporations and limited liability companies, and 4195 – other types of organizations. This distribution is not very different from our survey sample, where we have about 65% municipal, 20% regional and 15% federal organizations (Table 1 reports means for Fed, Reg and Mun as a fraction of the overall sample, here we report distribution within the 44FZ subsample) and about 30% corporations and limited liability companies within the 223FZ subsample (variable *FlexLaw* in Table 1).<sup>15</sup>

To track procedures that apply environmental criteria, we resort to the content analysis of procurement documentation. A similar approach is used by Rosell (2021) who uses machine search for environmental criteria in procurement procedures in the EU, proxying these criteria by two keywords: “environment” and “sustainable”. We apply the following words potentially used in the Russian procurement documentation to include requirements that can be classified as environmental (here we give English equivalents of the Russian words used): durable, reuse, multipurpose, renewable energy, maintainable, best available technologies, GOST ISO 14001 (the code for the state standard for environmental management systems), recycling, energy efficiency, reusable packaging, biodegradable, and their grammatical forms and modifications. We did not use combinations of the words “environment” and “sustainable”, since, from the semantic point of view, it is hard to distinguish between various meanings of their equivalents in Russian. In addition, the terms “environment” and “sustainable” are found in the names of a number of enterprises, which does not necessarily indicate

<sup>15</sup> For comparison, the RF Ministry of Finance reports the following distributions of organizations subject to 44FZ registered in the procurement system: 71.1% municipal, 19.4% regional and 9.5% federal authorities in 2018, and 71.4% municipal, 19.5% regional and 9.2% federal authorities in 2017. Source: <https://minfin.gov.ru/ru/performance/contracts/purchases/>. Note, these are registered organizations, whereby our sample reports organizations with completed procurement procedures only. Regions might have adopted centralized procurement systems, whereby organizations at the municipal level may delegate procurement to authorities at an upper level.

**Table 8**  
Assessment of the non-response bias (new survey, 2021).

	ECO	RepECO	LCC	ECO	RepECO	LCC	ECO	RepECO	LCC
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
RigidLaw	-0.0611*** (0.0193)	-0.102*** (0.0357)	-0.116*** (0.0398)	-0.0813** (0.0368)	-0.102*** (0.0361)	-0.107*** (0.0402)	-0.0711** (0.0345)	-0.109** (0.0477)	-0.100* (0.0523)
NonResp				0.0455 (0.0317)	0.00481 (0.0288)	-0.0541* (0.0312)	-0.0109 (0.0301)	0.00147 (0.0326)	-0.0511 (0.0349)
LARGE	0.178*** (0.0256)	0.131*** (0.0240)	0.223*** (0.0244)	0.150*** (0.0265)	0.132*** (0.0249)	0.211*** (0.0256)	0.147*** (0.0270)	0.132*** (0.0253)	0.212*** (0.0259)
STNDS	0.141*** (0.0283)	0.353*** (0.0203)	0.245*** (0.0272)	0.172*** (0.0283)	0.352*** (0.0210)	0.256*** (0.0275)	0.174*** (0.0285)	0.353*** (0.0212)	0.255*** (0.0278)
RigidLaw × NonResp							0.0486 (0.0793)	0.0163 (0.0739)	-0.0161 (0.0830)
Pseudo_R2	0.0809	0.1412	0.0984	0.0810	0.1430	0.0993	0.0817	0.1431	0.1006
Prob > chi2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
AIC	997.4569	988.006	931.3946	999.4014	987.9583	932.449	1000.656	989.8849	933.1328
BIC	1016.304	1006.897	949.9384	1022.96	1011.571	955.6287	1028.926	1018.221	960.9485
Obs.	822	831	762	822	831	762	822	831	762

Notes: Probit, average marginal effects. Statistical significance levels: 1% (\*\*\*), 5% (\*\*) and 10% (\*). Standard errors in parentheses. Main regression statistics Pseudo\_R2, likelihood ratio chi-square, AIC, and BIC from probit estimation.

the procurement procedure was green. We assign ECO = 1 if one of the above words was found in the procurement documentation (we interpret it as high probability of having a green procedure). Variables “Mun” and “FlexLaw” also can be tracked through the content analysis. However, control variables “EAS”, “RepECO”, “STNDS”, “Model\_crit” cannot be constructed on this data.

The fraction of procedures classified as green (ECO = 1) in the RUIS-S sample is 0.23, below that in the main survey sample. This is not unexpected as the survey sample may be biased towards organizations who have some experience with green procurement (see discussion in Section 4.2) and as our measure of environmental criteria (machine search for specific words) is likely to underestimate the fraction of green procedures. Still, the significantly different from zero ( $p = 0.0000$ ) value of ECO confirms organizations adopt environmental procurement practices despite not being required to do so. Our main interest is however in the role the law and the position in the power hierarchy play in organizations’ decisions to include environmental criteria in procurement.

Using ECO as a dependent variable, we estimate Eqs. (1) and (2) without controls on our survey sample, and on the RUIS-S sample. We also report estimates for a sample that preserves the uniform distribution of procurement procedures across regions (due to limitations of computational capacities we randomly selected 30% procedures from 10,000 downloaded entries for each region; dropping entries with missing organization type results in 249,767 observations). This sample (RUIS-U, for “uniform”) downplays the impact of big cities and regions like Moscow and St Petersburg and places more emphasis on less active players in the procurement system. The average ECO value for this sample is 0.162. Estimation results are in Table 9.

For the survey sample, removing controls does not substantially affect the estimates (compare columns 1, 4 and 7 in Table 9 with column 1 in Tables 2, 3 and 4 respectively). All coefficients for the RUIS-S and RUIS-U samples are of the same sign as for the survey sample, confirming the out of sample validity of our previous conclusions: being subject to the rigid law decreases the likelihood of using environmental criteria in procurement, more so for municipal bodies. For both RUIS-samples coefficients are smaller in size but recall the mean value of ECO there is also smaller: for example, a reduction in the likelihood of including environmental criteria by 7.1 percentage points due to RigidLaw (column 2 in Table 9) constitutes almost a half of the mean value of the dependent variable in the RUIS-U sample, more than what we observed in the survey sample. The economic significance of relationships obtained on the RUIS-S and RUIS-U samples is therefore also well comparable with findings obtained on the survey sample.

## 5. Discussion and conclusions

Our key finding is that organizations subject to public procurement regulation in Russia are more likely to implement environmental criteria in procurement procedures if they are governed by the more flexible law 223FZ, than if they fall under the rather rigid 44FZ, although neither of the two laws contains requirements with respect to green procurement. Previous studies, such as Raza (2020), Yang (2018), Sparrevik et al. (2018) and Yuen et al. (2017), show regulations exert coercive institutional pressure on companies, which results in a positive effect on the adoption of various types of green practices. These and similar results illustrate explicit incentives created by the regulation; rigidity here plays a positive role, forcing organizations to adhere to the promoted norms. In contrast, our focus is on implicit incentives, as the two laws we consider provide no explicit incentives to act green. In this case rigidity appears to play a negative role: procurement specialists get used to strictly follow the prescriptions of the law, knowing deviations from them may incur penalties. This creates caution, which makes managers prefer traditional well-trying, tested and practical approaches over novel pro-environmental decisions which might lead someone to interpret them as a violation of the law. We observe this same effect not only on the whole sample, but also on the subsample of organizations subject to the more flexible law 223FZ: here organizations that also have to follow 44FZ in some of their purchases, are less likely to use environmental criteria in procurement, than the rest of the subsample.

With respect to effects of regulations that lack specific provisions, Zhu et al. (2013) survey 193 Chinese government officials to identify factors that affect adoption of green procurement principles. Their institutional setting is somewhat similar to ours: environmental regulations they consider contain no significant punishment for not adhering to the green principles. Like the above cited studies, they find that regulation has a positive effect in promoting green public procurement, yet the unexpected result is that a better knowledge of green procurement regulations makes officials more reluctant to adopt green procurement practices (for example, Michelsen and de Boer (2009) and Testa et al. (2012) find the level of awareness about official standards has a positive effect on the adoption of green procurement). The authors explain this result by assuming that the greater familiarity with regulations makes officials confident no punishment will follow, or that since green procurement practices are not explicitly stated in the law, officials with a good knowledge of the law ignore these practices, however their data does not allow them to explicitly test these assumptions. This assumes no or very weak implicit incentives, yet the region that Zhu et al. (2013) study serves an example of pro-environmentalism in China, and thus environmental principles are widely promoted in the society, which

Table 9

Robustness check (survey vs. registered procurement procedures).

	Full sample			44FZ			223FZ		
	Survey	RUIS-U	RUIS-S	Survey	RUIS-U	RUIS-S	Survey	RUIS-U	RUIS-S
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
RigidLaw	−0.171*** (0.0608)	−0.071*** (0.007)	−0.093*** (0.009)	–	–	–	–	–	–
Mun	–	–	–	−0.236*** (0.061)	−0.050*** (0.005)	−0.073*** (0.008)	–	–	–
FlexLaw	–	–	–	–	–	–	0.267*** (0.084)	0.080*** (0.00)	0.103*** (0.010)
Pseudo_R2	0.1532	0.131	0.112	0.1221	0.0930	0.0824	0.116	0.107	0.0989
Prob > chi2	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000	0.0000
AIC	931.3576	988.2423	1003.3294	895.3289	920.7068	936.4563	857.3908	898.5493	975.2043
BIC	962.8697	1017.2358	1029.3458	978.7609	997.3241	1005.6987	921.3243	953.4309	1015.2309
Obs.	223	249,767	98,943	118	145,661	53,428	105	104,106	45,515

Notes: Dependent variable “ECO”. Probit regressions, average marginal effects (AME). Standard errors in parentheses \*\*\*  $p < 0.01$ , \*\*  $p < 0.05$ , \*  $p < 0.1$ . Main regression statistics Pseudo\_R2, likelihood ratio chi-square, AIC, and BIC from probit estimation.

exerts informal institutional pressure. Our argument allows for implicit incentives, and empirically we find a significant manifestation of implicit incentives in the adoption of green procurement principles, although caution also plays an important role. We therefore may re-interpret [Zhu et al. \(2013\)](#) result as potentially demonstrating that officials who have a better knowledge of the law, exhibit higher caution – for example, because they may be simultaneously exposed to other laws with explicit punishments.

As for the factors that are internal to organizations (such as awareness), according to [Fang et al. \(2020\)](#) they are even of higher importance than external factors such as regulation and legislation. [Vejaratnam et al. \(2020\)](#) also find that unawareness is the most important barrier to green procurement, while financial considerations (procurement cost) are not as prominent as one would expect.<sup>16</sup> Both findings speak in favor of our theoretical framework and conclusions from it. However, [Fang et al. \(2020\)](#) caution that the lack of externally designed incentives from the side of policymakers may aggravate internal barriers. Our emphasis was instead on implicit incentives. Legislation in our context proves an important factor even if it does not contain relevant provisions: indirectly, it affects the perception of uncertainty with respect to potential costly errors and unintended contraventions. Jointly, [Fang et al. \(2020\)](#) and our results highlight a non-trivial interplay between internal factors (which may be barriers or motivation) and legislation, with a conclusion that the legislation should be clear, provide guidance, and encourage initiative and innovative solutions. In a similar vein, [Thomson and Jackson \(2007\)](#) highlight the role of legislations, information provision and removal of barriers in the promotion of green procurement in the UK.

Our paper adds to the current debate on the extent to which the administrative power of an organization affects adoption of green procurement. [Renda et al. \(2012\)](#) and [Rosell \(2021\)](#) report local governments in the EU are more likely to do so, consistent with [Testa et al. \(2016\)](#) who show this for smaller organizations (usually municipal organizations are small). As stressed by [Rosell \(2021\)](#), greater bureaucracy and rigidities (often associated with large and complex national administrations) reduce implementation of GPP, while “contracting authorities, such as agencies, those governed by public law, and other types, have more flexibility in the procurement process” and through that achieve higher levels of GPP. However, for works contracts in Spain, [Rosell \(2021\)](#) reports a higher usage of green criteria by national

<sup>16</sup> [Smith et al. \(2016\)](#) provide further evidence on internal and organizational pro-environmental facilitators. They show, inter alia, support from top management, clear political goals, cross-departmental commitment and co-operation under budget constraints, are imperative to successful implementation of pro-environmental procurement practices.

administrations than by local authorities; similar findings are in [Fuentes-Bargues et al. \(2017\)](#). This aligns with our results on the Russian data and with the results of [Liu et al. \(2019\)](#) on Chinese data. These comparisons stress the aforementioned bureaucracy and rigidities may affect organizations at lower levels of power hierarchy and suggest importance of the wider institutional setting, which in China and Russia may be quite different from that in the EU, and which may also somewhat differ across EU countries. It appears that the flexibility that smaller (municipal) organizations have and should exploit, on average successfully counteracts bureaucracy and caution in the EU system, while the lack of flexibility and high caution in China and in Russia generate the opposite effect. More research on the role of the overall institutional setting is needed. One implication might be that policy recommendations that work well in one setting, might be inefficient in others.

Several limitations should be mentioned. First, the size of the original sample is rather small. Although we used more data from a larger survey and from the official public procurement database, and key results stand, detailed information on the internal organization of public procurement processes within procurement entities, such as those we have from the main survey, is highly desirable to shed more light on the extent to which information factors and informal institutions determine the adoption and spread of GPP. We would encourage inclusion of relevant questions in further surveys on GPP. Second, the identification of the rigid legislation effect is somewhat contaminated by the organization type effect. Our strategy was to isolate the organization type effect from the law effect by focusing on subsamples governed by one law – organization placed higher in the power hierarchy under the rigid law show stronger acceptance of GPP, while on the subsample governed by the flexible law these are corporations, hence the power hierarchy cannot explain the relationship. A purely random distribution of organization types over laws is hardly possible. For a better identification, one might need to exploit data around a regulatory change (when all organizations are affected simultaneously), which is an interesting direction for future research.

To sum up, despite no regulatory requirement to do so, a significant fraction of organizations in our sample use environmental criteria in procurement, and use them repeatedly, yet organizations funded from the Federal budget (which are supposed to have stronger incentives to demonstrate compliance with government objectives) are less likely to act pro-environmentally than other types of institutions and enterprises in our sample. This suggests strong implicit incentives to behave pro-environmentally stem from informal institutions like culture, habits and shared values, rather than from the willingness to align with the declared priorities of the government. Still, public bodies standing high in the power hierarchy exhibit more pro-environmentalism in their procurement practices, potentially attributable to reduced caution due to better connectedness and administrative power. Overall,

organizations subject to a more rigid procurement regulation, even if only in some part of their procurement activities, demonstrate less GPP than organizations under more flexible regulations. From a policy perspective, clear guidance on how to implement environmental procurement and less rigidity in regulation would help towards more GPP through pressure from informal institutions. A managerial implication from our study is that investments in improvement of environmental awareness of staff alone may be insufficient to promote GPP. On top of that, establishing internal GPP strategies and regular GPP training would help reduce the caution factor, as would do the improved communication with other procurement entities on approaches and experiences with GPP.

### Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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### Appendix. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.ecolecon.2022.107458>.

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