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Voluntary adoption of environmental standards and limited attention: Evidence from the food and beverage industry in Vietnam

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Abstract

Voluntary approaches to environmental policy can contribute to stemming environmental degradation in developing countries with weak institutions. We evaluate the role of a behavioral anomaly, limited attention paid by owners or managers, in explaining the voluntary adoption of environmental certification by small and medium enterprises (SMEs) in the food and beverage industry in Vietnam. We find that firms where owners or managers were inattentive were 30 percentage points less likely to receive environmental certification. Moreover, this effect is larger for firms that were previously inspected for technical violations, and that exported or bribed, and it is weaker for household enterprises.

JEL Classification: D22, D83; D91; O13; Q56; Q59

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1 Introduction

Environmental degradation and climate change have significant negative consequences, not only on environmental quality and ecosystems, but also on food security, human health as well on livelihoods, both at the global as well as local levels (IPCC, 2014). Given the scale of the problem, especially in developing countries that are least equipped to deal with its consequences (World Bank, 2010), it is imperative to identify possible policy measures that may be relevant in ensuring environmental protection in these contexts, and to understand how to enhance their effectiveness.

Poor environmental quality is considered to be a hallmark of many areas in developing countries, especially as the process of development and urbanization gets underway. Pollution due to industrial activities, exploitation of natural resources, biodiversity destruction, deforestation, as well as the unsustainable development of agriculture and aquaculture systems are some of the typical problems encountered in these settings, often exacerbated by rapid population growth. The industrial sector is a significant contributor to environmental degradation in developing countries; for instance, it is one of the leading causes of water, solid waste and air pollution in Vietnam (International Trade Administration, 2019). Thus, it is critical to ensure that firms in developing countries find means to reduce their negative environmental impact, and thereby advance the cause of sustainable development.

The set of available policy instruments that may be utilized to mitigate the environmental impact of firms can be categorized as those primarily employed by the state, and others which require initiative to be taken by the firms themselves. The state must often intervene in the design and implementation of environmental policy instruments; these can broadly be classified as 'market-based instruments' that encourage changes in behavior through market signals (such as pollution charges, tradable permits, or subsidies) and 'non-market-based instruments' (including command-and-control regulations such as technology or performance standards, as well as information disclosure programs). Examples of environmental policy initiatives that can be taken by firms include corporate social responsibility (CSR) programs, as well as the adoption of voluntary certification (such as 'ecolabels') and environmental standards.

Voluntary certification and standards have been found to have the potential to achieve environmental targets in developing countries, at least under some conditions (Blackman 2010; Blackman and Guerrero 2012), in a context where traditional command-and-control policies have not always been very effective (Eskeland and Jimenez, 1992), often because of poor enforcement, lack of funding or trained personnel, lack of political will and a lack of awareness. Weak institutions, and the associated shortcomings in regulatory capacity and implementation, have meant that policy instruments such as voluntary standards and certifications may be an effective means to ensure 'self-regulation' by firms (Khanna and Liao (2014) provide a comprehensive overview of the literature on voluntary standards in developing countries).

The current literature on environmental voluntary standards for firms in developing countries has evaluated the motivation for firms to obtain these certifications, and found that firms often undertake these in response to pressure from regulators, consumers, investors, or environmental interest groups (Khanna and Liao, 2014). Examples of some firm-level characteristics that determine voluntary certification have been found to be foreign direct investment, firm size, whether the firm exports, and production of intermediate products (Tambunlertchai et al., 2013).

However, this literature also finds significant heterogeneity in adoption of these standards, and that not all firms that may benefit from their adoption actually do so (Khanna and Liao, 2014).

To the best of our knowledge, this literature has not considered owner (or manager)-specific behavioral traits that may determine voluntary certification outcomes. For instance, limited attention (or lack of knowledge) on the presence or availability of these standards could explain why some firms do not adopt them. Limited attention has been found to be an important determinant of firms not undertaking actions that may be in their best interest in developing countries (Beaman et al., 2014). The recent behavioral economics literature on limited attention suggests that firm owners may have trouble in attending to all aspects of their business, or have limited capacity to process all available information (Dellavigna 2009; Gabaix and Laibson 2006; Koszegi and Szeidl 2013; Hirshleifer and Teoh 2003). This may explain why in some contexts, firm owners may not adopt these standards, even if it may be beneficial to do so.

In this paper, our objective is to evaluate the role of limited attention in explaining the voluntary adoption of environmental certification by small and medium enterprises (SMEs) in the food and beverage industry in Vietnam. Vietnam has grown rapidly in recent decades, and small and medium enterprises have been the dynamic force behind this growth, comprising almost 98% of all enterprises, and employing more than 60% of the workforce (General Statistics Office, 2015). However, this industrialization has resulted in significant environmental deterioration: Vietnam ranks 132 out of 180 countries in the Environmental Protection Index (Wendling et al., 2018), and it ranks among the most affected countries in terms of air pollution (IQAir, 2019). The food and beverage industry is one of the most pollution-intensive industries in Vietnam, and it is significant for both its scale of production, and the pollution load.

At the same time, its growing middle class is also demanding products certified as being environmentally-friendly: according to a recent survey, Vietnamese consumers are among the most socially-conscious in Asia-Pacific. Up to 86% of consumers in Vietnam are willing to pay more for products and services from firms that are committed to having a positive social and environmental impact (Nielsen, 2015). Thus, in this context, not only may policy instruments such as voluntary environmental certificates contribute towards achieving environmental goals in Vietnam, but they are also likely to bring benefits to firms that obtain them (such as the potential for increased demand for their products).

In particular, in this study, we analyze the effect of limited attention on whether firms have applied for and received an environmental standards certificate, also known as the 'certification for environmental protection works'. We capture limited attention by whether owners or managers of the firm are unaware of (or lack knowledge on) the Law on Environmental Protection (LEP), which contains detailed and extensive information on how firms can obtain this certification, and is thus an important source of information on how firms can get certified. While obtaining this certification is mandatory for large firms belonging to specific sectors in Vietnam, in this paper, we focus on the voluntary adoption of these standards in a sample of small and medium enterprises. Firms can benefit from obtaining these certificates, by experiencing an increase in domestic demand for their products, as well as by increasing their likelihood of exporting their goods. Moreover, firms producing intermediate goods can use the standard to attract firms that require certification by their suppliers as potential customers. Of course, obtaining environmental certification is also likely to entail costs for these firms, which may be steeper for smaller businesses. However, it can be foreseen that at least for some firms, the benefits may outweigh the costs.

The focus of this paper is on a sample comprising predominantly small and medium enterprises (SMEs) in the food and beverage industry of Vietnam. We use unbalanced panel data from the UNU-WIDER Vietnam SME firm-level database (United Nations University UNU-WIDER, 2011) that collects information on about 2500 firms, mostly SMEs, from 2011-2015 biennially.

Our paper presents evidence spanning various estimation methodologies on the effect of limited attention on certification. We employ a probit estimator, a recursive bivariate estimator that is equipped to correct for possible endogeneity, and combine the recursive bivariate methodology with the Mundlak/Chamberlain adjustment (Mundlak 1978; Chamberlain 1982) to address possible unobserved heterogeneity. While the use of the recursive bivariate framework enables identification through assumptions on functional form, we also choose to employ an excluded instrument (the occupational skill level of the parents of the respondents) in our first-stage estimation.

Our contribution to the literature is that our study provides suggestive evidence on the role that behavioral anomalies (such as limited attention) can play in hindering voluntary certification by firms in a developing country. We use self-reported information on awareness about the LEP to establish that firms where owners or managers are more attentive to availability of instruments such as environmental certificates are more likely to make conscious efforts to treat environmental factors (and thus satisfy environmental standards).

Moreover, we also add to the literature on the determinants of limited attention on part of owners and managers, and identify both firm-level and respondent-level factors that may lead to individuals being more aware/knowledgeable of environmental laws. Of course, these factors are likely to be context-specific, however, they still provide interesting insights into how policy-makers can target information and education campaigns.

The policy implications of this study relate to the importance of informing and educating firm owners and managers about the availability of voluntary environmental instruments, as well as enabling them to understand laws better, given that awareness about the laws is likely to weaken at least some information constraints for small and medium enterprises. For instance, it can be expected that firms that are attentive to the laws are not only going to comply with mandatory environmental regulations, but as our results suggest, may also be more likely to adopt voluntary instruments. This is of pivotal interest in developing countries, where weak institutions and a lack of information may hamper the uptake of environmental policy initiatives by firms. Thus, bringing laws and regulations to salience for firms is a low-hanging fruit that policy-makers can effectively utilise to improve environmental outcomes.

The structure of the paper is as follows: Section 2 includes a background on the environmental law and voluntary standards in Vietnam, Section 3 provides a brief review of the literature, Section 4 provides details on the data and methodology used for the analysis, Section 5 includes the main results of the paper as well as additional results, while Section 6 concludes and includes policy implications.

2 Background

Vietnam is one of the most rapidly transforming countries not only in East Asia, but also in the world: following the phase of economic and political reforms called Doi Moi in 1986,

the economy liberalised significantly, and poverty rates declined sharply. For instance, from 2002 to 2018, poverty rates declined from over 70% to below 6% (at USD 3.2 per day at purchasing power parity), and gross domestic product per capita increased 2.5 times, to USD 2,500 in 2018 (World Bank, 2019). However, future expected economic growth, coupled with the associated industrialization and urbanization, imply that there may be significant pressures on environmental sustainability in the country.

According to estimates from the General Statistics Office (GSO) of Vietnam, almost 98% of all enterprises operating in Vietnam were SMEs (General Statistics Office, 2015). As of 2015, they accounted for about 64% of employment, and 45% of the country's GDP. Given their share in Vietnam's economy, and the contribution of the industrial sector to environmental degradation in Vietnam, it is reasonably important to ensure that owners and managers of SMEs are environmentally-conscious, and that they proactively address environmental issues.

The key regulatory instrument at the disposal of policy-makers in Vietnam is the LEP. The framing of environmental regulation in Vietnam began with the passing of the LEP in 1993, providing the framework for legal, institutional and administrative instruments for environmental protection in Vietnam. The law was substantially amended in 2005 (as well as in 2015) to increase the stringency of enforcement, as well as to increase the scope of regulation to tackle the environmental challenges in the country. This law serves as the basis for industrial pollution management policies in Vietnam, as well as for the framing and implementation of environmental standards.

The LEP requires that firms that can produce at a certain minimum scale in specific industries conduct an environmental impact assessment (EIA) before starting operations, with the right to start or continue their business only when their EIA reports have been reviewed, and approved by the State Management Agency for Environmental Protection (The Government of Vietnam, 2015; Vietnam Law and Legal Forum, 2008).[1] The EIA is expected to provide a detailed description of the project, as well as important information on its environmental impact on the site, and potential risks due to environmental incidents.

On being granted the approval for the EIA, they then must submit documents in order to get an inspection done for pollution control. Firms are granted an environmental standards certificate (ESC), or "certificate for completion of environmental protection works" (as it is now called after the amendment of the LEP in 2015) if they comply with the requirements set forth in the EIA, specifying the environmental factor that firm owners are aiming to treat, as well as successfully pass the inspection requirements (Vietnam Law and Legal Forum, 2008).

While obtaining the ESC is mandatory for firms having a minimum production capacity in some industries,[2] other firms can obtain the ESC on a voluntary basis.[3] In this paper, we will focus on the voluntary adoption of the ESC by firms in the food and beverage industry. The relevant legal documents contain information on the requirements, not only for mandatory compliance by firms that are required to conduct the EIA and obtain the ESC, but also for firms that are

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[1]All other firms that are not required to submit an EIA (i.e. the smaller firms) are expected to submit an environmental protection plan, barring firms belonging to specific sectors or lines of business, such as retail establishments.

[2]Firms that do not conduct an EIA (if they are required to do so), and thus do not obtain the ESC, may face sanctions, varying in severity from monetary penalties, to a complete shutdown.

[3]The Government of Vietnam (2015) provide the list of sub-sectors within each industry that are required to obtain the ESC, aw well as the associated production capacities for each sub-sector.

looking to obtain voluntary certification. Thus, being knowledgeable or aware of the LEP is likely to be a pivotal channel of information on the steps to obtain voluntary certification.

The food and beverage industry comprised the largest share of all enterprises, with 4480, or 21.9% of 20444 manufacturing firms in the country in 2004 belonging to it (Dore et al., 2008). Not only did this sector represent 40.4% of the total value produced by locally owned state enterprises, it also represented the largest share of all industrial value produced by both the domestic private sector (29.8%), and the foreign-invested sector (18.7%) in Vietnam in 2004 (Dore et al., 2008). Thus, it is an economically significant sector in Vietnam.

The food and beverage industry is also one of the most pollution-intensive industries in Vietnam. Food processing (particularly, seafood processing)[4] as a sub-industry has a very high overall environmental impact, and is significant for both its scale of production, and the pollution load. Dore et al. (2008) identify this sector, along with textiles, and chemical and chemical products, as the three biggest contributors to industrial pollution in Vietnam.[5] Food processing sub-industries are also some of the biggest contributors to the release of toxic materials into the land in Vietnam (Dore et al., 2008).

3   Previous Literature

Our paper fits into two strands of the economic literature, one on the determinants of adoption of voluntary environmental standards and certificates by firms, and the other on the role of limited attention as a behavioral anomaly in determining economic decisions.

Voluntary approaches for environmental protection have been used in several settings as an environmental policy instrument. In general, they have gained traction in industrialized countries, because of the benefits they offer over command-and-control regulation (such as speedier implementation, or reducing the administrative burden on regulatory agencies). Common examples of voluntary approaches adopted include participation in public voluntary programs established by regulatory agencies, negotiated agreements between governments and firms, and initiatives adopted independently by firms, such as certification, eco-labels, and adoption of environmental management systems (such as the ISO-14001) (Khanna and Liao, 2014).

The literature on the adoption of voluntary environmental certification and standards in these countries has found that the effectiveness of this policy is, in many cases, mitigated due to "selection-type" problems, namely that only the cleanest firms and plants obtain these certificates (Vidovic and Khanna, 2007). For these firms, the marginal costs of certification are low, and the benefits are often of considerable magnitude.

Firms often adopt these standards under the influence of regulators, consumers, or environmental interest groups. They may do so to minimize current and future costs of compliance with

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[4]Seafood processing includes cold-storage; freezing; drying; and smoking and canning of fish, shrimp, squid, shellfish, algae, and other marine products. It also includes the production of fish ol and sauces, seasoning products, and fish meal.

[5]While there is scant information on pollution abatement and control expenditures by firms in Vietnam, the Vietnam General Statistics Office (GSO) conducted a business survey in 2002 where this was asked to firms. While not all firms provided this information, among those that did, the food and beverage industry was the leading industrial sector for pollution abatement and control expenditures (in terms of amount spent) (Dore et al., 2008).

environmental regulations (as Decker (2003) shows, firms obtain permits for new facilities more quickly if they have engaged in voluntary abatement); they may do so to nudge regulators about their compliance (and thus, avoid stricter monitoring), or they may do so to influence the design and prevent the increase in stringency of future regulations (Segerson and Miceli, 1998). For instance, Videras and Alberini (2000), Innes and Sam (2008) and Vidovic and Khanna (2007) all find that firms were more likely to join the voluntary 33/50 Program of the United States Environmental Protection Agency (EPA) if they had more polluting sites, and released more toxic chemicals.

Of course, signalling about the environmentally-friendly nature of their production to consumers (Arora and Gangopadhyay, 1995), or attracting workers (who may be drawn to firms that project themselves to be environmentally conscious) are other important reasons for firms in industrialized countries to get certified on a voluntary basis (Khanna and Liao, 2014). Evidence from industrialized countries also suggests that firms with more educated managers or workers, or those where managers had a bent towards protecting the environment, were more likely to adopt voluntary certificates (Ervin et al. 2012; Khanna and Speir 2013).

This literature finds a role for mandatory environmental regulation in spurring firms to obtain voluntary certification: Arimura et al. (2008) use data on Japanese firms, and find that plants subject to environmental performance standards and input taxes were more likely to be certified with the ISO 14001, while Potoski and Prakash (2005) find that plants inspected more often were more likely to be certified with it. Other important determinants of certification for firms in industrialized countries include firm size (which is found to be positively associated with adoption) (Arimura et al. 2008; King et al. 2005; Potoski and Prakash 2005) and sales to foreign buyers (King et al., 2005).

Environmental regulation take on a different dimension in developing countries, where weak institutions are a deterrent towards enforcement of regulation. Several papers in development economics have shown that in these settings, policy failures are common, especially when weak incentives and corruption are rampant (Banerjee et al. 2008; Duflo et al. 2012; Banerjee et al. 2013). Eskeland and Jimenez (1992) provide an introduction to the problems of enforcing policy instruments such as fiscal incentives and performance standards in settings with weak institutional characteristics.

The literature on voluntary environmental certification as an environmental policy instrument in developing countries is relatively thin. Given weak institutions, limited capacity to regulate and costly monitoring, the case for voluntary environmental programs such as certification and standards in developing countries is strong. Command-and-control regulation has been known to face institutional and political challenges in low and income country-settings (Eskeland and Jimenez, 1992). However, Vincent (2010) provides a comprehensive summary of studies that have found that alternate pollution control measures (such as public disclosure and voluntary programs) may have limited success in developing countries in some contexts. In contrast to industrialized countries, voluntary programs in developing countries are generally used to facilitate compliance with mandatory regulation (Blackman and Guerrero, 2012).

Blackman et al. (2010) evaluated Mexico's Clean Industry Program, and found that plants that were fined for regulatory violations were more likely to participate in this voluntary program (that awarded firms recognition for submitting to an environmental audit), and that these firms were large and exported to foreign markets (and thus, were more likely to work to satisfy their

customer's requirements, rather than only meet domestic regulations). The finding regarding firm size determining participation in voluntary programs is confirmed by Christmann and Taylor (2001) for Chinese firms and Tambunlertchai et al. (2013) for Thai firms, and regarding firms linked to overseas markets being more likely to participate is also confirmed by Montiel and Husted (2009) for Mexican firms, and again by Tambunlertchai et al. (2013).

Blackman et al. (2010) suggests that there are disparities in the adoption of voluntary programs, both within and across developing countries. While several firm-specific characteristics have been used to explain their adoption, the role of owner-specific traits, such as behavioral anomalies or biases that they may have, has not been explored in the literature, to the best of our knowledge. One factor that may explain the under-adoption of such instruments by some firms is a lack of knowledge or awareness of the availability of such instruments, or limited attention paid to them by owners of the firms. The vast theoretical literature on limited attention (Dellavigna 2009; Gabaix and Laibson 2006, Koszegi and Szeidl 2013; Bordalo et al. 2013) pinpoints that owners and managers at firms may have limited ability to process all available information, and thus that they may not always take optimal business decisions.

There is an empirical literature from industrialized countries on the role of limited attention (also known as behavioral inattention) in undermining consumer decisions (Chetty et al. 2009; Hossain and Morgan 2006). There is also emerging evidence from developing countries: limited attention has been found to be an important determinant of sub-optimal decisions made by firms, as well as individuals. Beaman et al. (2014), for example, provide evidence from two randomized controlled trials with micro-enterprises in Kenya on the impact of bringing to salience the importance of keeping change, and found that firms were more attentive to keeping change to run their businesses in response to being informed about it. Hanna et al. (2014) apply the model of limited attention to explain the decision of seaweed farmers in Indonesia to ignore information on pod size, which is an important input in determining output. Karlan et al. (2016) provide evidence from Bolivia, Peru and the Philippines on the role of reminders in inducing saving behavior among clients of banks.

To our knowledge, our paper is one of the first economic studies to look at the effect of limited attention (or knowledge) on voluntary adoption of environmental certificates by firms in a developing country. We are aware of a couple of other studies that have looked at the role of policy or regulation awareness in environmentally-oriented settings: Nkonya et al. (2008) assessed the effect of awareness on compliance with by-laws related to community resource management in Uganda, and Cerruti et al. (2019) evaluated the impact of policy awareness on the decision of households to invest in energy-efficient cars in Switzerland. Both studies have found awareness of regulations/policies to have a significant impact on decisions.

While we confirm some of the previous results on the role of firm size and exporting behavior on the decision of firms to adopt environmental certificates voluntarily in developing countries, the novelty of our study is that we focus on the role of limited attention paid to the LEP, which is a source of information on these certificates, in determining this outcome. Limited attention in this setting may imply a lack of awareness on the existence of the law. Another aspect of limited attention may be a lack of understanding of what the law entails for the firms. While we are not able to disentangle the two effects in our data, we are able to capture the aggregate effect of a lack of knowledge, or awareness, on adoption of these certificates. We control for characteristics that may determine the mandatory adoption of these standards, as well as for inspections faced by firms (one of the means of enforcement), and thus we focus on the role

that limited attention may play in their voluntary adoption.

4 Empirical Approach and Data

4.1 Model Specification and Empirical Approach

In order to estimate the effect of limited attention on the likelihood of obtaining the certificate for meeting environmental standards on a voluntary basis, we first estimate a simple discrete-choice model. Given the binary nature of our dependent variable, from an econometric point of view, we choose to estimate a probit model. The model specification is as follows:

$$C_{i,t} = \alpha_0 + A_{i,t}\alpha_1 + X_{i,t}\alpha_2 + \eta_j + \gamma_t + \lambda_k + \mu_{i,t} \tag{1}$$

We define the variables used in the model below. $C_{i,t}$, our dependent variable, is a binary variable capturing whether the firm 'i' had an ESC (or a certificate for satisfying environmental standards) in period 't'. The main independent variable $A_{i,t}$ is a binary variable, indicating whether the respondent (either the owner, or the manager of the firm) had paid 'limited attention' to the Law of Environmental Protection (LEP) (which provides detailed information on how firms can obtain the ESC) in period 't'.[6] $X_{i,t}$ denote the set of controls, η_j denotes a set of province 'j'-specific dummy variables, γ_t denotes year fixed effects, and λ_k denotes sub-sector 'k'-specific dummies. The set of control variables in the estimation $X_{i,t}$ includes various firm-level characteristics (such as whether the firm is a household enterprise, whether the firm has internet access, age of the firm, whether the firm exports, etc.) and respondent-level characteristics (such as gender, age, level of education, etc.).

As mentioned in the previous section, the adoption of the ESC is mandatory for large firms (based on annual production capacity) within some sub-sectors, and it is voluntary for other firms within the food and beverage industry. In this study, we focus on the voluntary adoption of these standards, accounting for the firms that need to obtain the ESC on a compulsory basis by including a dummy variable that captures compliance. More details are provided in the Data sub-section.

In our dataset, the LEP awareness variable is categorical and with four levels for possible responses: "good", "average", "poor" and "no knowledge or not of my interest". There are two reasons for us choosing to convert this information into a binary variable. Firstly, the category "no knowledge or not of my interest" has the maximum responses, with 59% of respondents belonging to it (the shares are 2%, 13% and 26% for the remaining three categories, respectively). Secondly, the differences between the categories "good, "average" and "poor" are not necessarily clearly defined, and may introduce an element of subjectivity into our measure, whereas the fourth category is more unambiguous in definition, in our opinion. Thus, we categorize firms as having 'limited attention' of the LEP if the respondents stated that they had no knowledge of the law, or that it was not of their interest.

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[6]While the 2005 Law on Environmental Protection would have been valid for the first two years of our study (2011 and 2013), the 2015 amendment would be relevant for the firms in the final year of our data (2015). However, both versions of the law are very similar in aspects related to obtaining the EIA approval and the ESC, and thus are treated as identical in our analysis.

While this estimation is a natural starting point, it is difficult to rule out the concern of endogeneity in the estimation of model 1. It is highly plausible, for example, that firms that have the certificate for meeting environmental standards are more likely to be aware of the LEP, which suggests possible reverse causality in the above estimation. Moreover, it is likely that both the likelihood of having received a certificate, as well as awareness of the LEP, are influenced by factors unobservable to an econometrician such as respondent-level characteristics (for instance, how law-abiding they are), or firm-level traits (such as whether the firm hired the services of a legal consultant), leading to the possibility of correlated unobservables. Lastly, measurement error in the variable capturing limited attention is also a possible threat to identification, since this information is self-reported.

In order to address these concerns, we estimate a bivariate probit model, adopting the recursive structure proposed by Maddala (1986). This is our preferred choice of estimation to mitigate endogeneity concerns, given that we use a binary version of the possibly endogenous variable in our model, following Greene (2008, 2018). In this context, we model the decision to get certified as a two-stage decision process. In the first stage we model whether the respondent (owner or manager) had limited knowledge (or paid limited attention to) the LEP, and then in the second stage, we model the choice of the firm to get the environmental certification. This two-stage process is modelled as shown below:

$$A_{i,t}^* = \beta_0 + \beta_2 Z_{i,t} + \beta_3 X_{i,t} + \eta_j + \gamma_t + \lambda_k + \epsilon_{i,t}, A_{i,t} = 1 \text{ if } A_{i,t}^* > 0, A_{i,t} = 0 \text{ otherwise,}$$
$$C_{i,t}^* = \alpha_0 + \alpha_1 A_{i,t} + \alpha_2 X_{i,t} + \eta_j + \gamma_t + \lambda_k + \mu_{i,t}, C_{i,t} = 1 \text{ if } C_{i,t}^* > 0, C_{i,t} = 0 \text{ otherwise.}$$
$$(2)$$

where the assumption is that

$$[\epsilon_{i,t}, \mu_{i,t}] \sim \phi_2[(0,0),(1,1),\rho], \rho \in [-1,1] \tag{3}$$

and where $A_{i,t}^*$ and $C_{i,t}^*$ denote vectors of the latent continuous variables (instead of which the binary variables $A_{i,t}$ and $C_{i,t}$ are observed to the econometrician), $Z_{i,t}$ denotes the vector of our instrumental variable, $X_{i,t}$ is the vector of control variables, and $(\epsilon_{i,t}, \mu_{i,t})$' is a vector of error terms described by ϕ_2, the bivariate standard normal distribution, with correlation given by ρ. The remaining variables are defined as they were earlier.

Model 2 is generally identified, even if $X_{1i} = X_{2i} = X_i$, i.e. the same set of control variables are used in both stages, granted enough variation is provided by the exogenous covariates in the model. In the narrow case in which $X_{1i} = X_{2i} = $ a set of dummy variables, the absence of an exclusion restriction may result in a failure of identification. A detailed discussion of this case, and on identification in the recursive bivariate model more generally, may be found in Wilde (2000), Mourifié and Méango (2014) and Han and Vytlacil (2017). Further discussion on identification is beyond the scope of this paper.

However, we choose to incorporate an excluded instrument in our model ($Z_{i,t}$), which is a constructed measure of the "skill level" of the occupations pursued by the parents of the respondent. It is an index, generated as the sum of the levels of skills of each parent, and measured using a categorical variable. We use this as an instrumental variable under the

premise that respondents (owners or managers) who are children of individuals who worked in high-skilled jobs (who are thus also more likely to have a higher level of education) are more likely to be aware of laws in general. Moreover, it is unlikely that the skills of the parents of the respondent will directly influence the certification received by the firm, once we control for respondent-level characteristics such as age, education, etc.[7]

In order to control for unobserved heterogeneity across firms in our sample, we could use a fixed effects version of the bivariate probit model. However, as discussed in Greene and Zhang (2019), the use of a fixed effects model within the framework of a nonlinear panel data model gives rise to the 'incidental parameter problem' and thus the estimates would be biased. Therefore, in order to deal with time-invariant unobserved heterogeneity, we choose to adopt the correlated random effects approach suggested by Mundlak (1978), Chamberlain (1982), and Wooldridge (2005, 2010). This approach is based on including time-averages of all variables having positive within variation in both first and second stages of the model (2) as controls. The model that we estimate is then transformed as follows:

$$a_{i,t}^* = \beta_0 + \beta_2 z_{i,t} + \beta_3 x_{i,t} + u_i + \eta_j + \gamma_t + \lambda_k + \epsilon_{i,t}, a_{i,t} = 1 \text{ if } a_{i,t}^* > 0, a_{i,t} = 0 \text{ otherwise,}$$

$$c_{i,t}^* = \alpha_0 + \alpha_1 a_{i,t} + \alpha_2 x_{i,t} + u_i + \eta_j + \gamma_t + \lambda_k + \mu_{i,t}, c_{i,t} = 1 \text{ if } c_{i,t}^* > 0, c_{i,t} = 0 \text{ otherwise.}$$

$$(4)$$

where we now assume that u_i can be substituted as

$$u_i = \psi_1 + \bar{x}_i \psi_2 + \delta_i, \delta_i | x_i \sim Normal(0, \sigma_{\delta_i}^2) \tag{5}$$

The Mundlak-Chamberlain adjustment models the firm-level heterogeneity term (u_i) to be a linear function of all exogenous variables x_i, including those that are omitted from model (2) above. In equation 5, the term δ_i is assumed to be independent of x_i. By substituting equation 5 in equation 4, $c_{i,t}$ is allowed to be correlated with unobserved heterogeneity, and the time-varying omitted factor (this approach has been extensively summarized in Greene (2018) and in Wooldridge (2010)).

Summarizing, our approach in this paper is to adopt three methodologies to evaluate the impact of limited attention on the likelihood of a firm having received the ESC: the probit model, the recursive bivariate probit model, as well as the recursive bivariate probit model with the Mundlak/Chamberlain adjustment. In the next section, we describe our data, and provide some important summary statistics on our modelling variables.

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[7]In our sample, the average age of the owners/managers of the firms is 48 years. Within the household of the respondents, the share of adults over the age of 60 is only about 9.5%, with 71% of respondents stating that their household had no members over the age of 60. Thus, we are of the opinion that it is unlikely that parents of the respondents will directly influence certification decisions, and that the magnitude of this effect, if it exists, will be negligible.

4.2 Data

For this study, we use data from the UNU-WIDER Vietnam SME firm-level database (United Nations University UNU-WIDER, 2011). The database tracks a sample of 2500 predominantly small and medium-sized firms in nine provinces of Vietnam biennially over the period 2011-2015, creating an unbalanced panel. The data set collects information on the economic accounts, as well as data on various enterprise-level, as well as some employee-level characteristics. The enterprises surveyed are distributed over approximately 18 different industries, including the food and beverage. Firms are classified according to the current World Bank definition, with micro-enterprises having up to 10 employees, small-scale enterprises up to 50 employees, medium-sized enterprises up to 300 employees, and large enterprises having more than 300 employees.[8] The database also includes variables related to firm performance, enterprise history, employment, business environment, and owner/ manager background characteristics.

The regression sample for our main results includes firm in the food and beverage industry with manufacturing as the main sector that do not change their industry over the duration of the sample. After accounting for missing values for some variables, this sample comprises 2216 observations. In order to focus on the voluntary adoption of the ESC in our sample, we first seek to identify those firms that are required to obtain the ESC on a mandatory basis according to the LEP, and account for this in our estimations by including a dummy variable that takes the value 1 for these firms that are required to comply, and thus obtain the ESC. The two main determinants for mandatory compliance by firms are the sub-sector that they operate in, and the production capacity of the firm. The appendix to The Government of Vietnam (2015) provides this list of sub-sectors, as well as the production capacity thresholds. Firms that belong to specific sub-sectors, and have a production capacity larger than this predefined threshold, are required to obtain the ESC.

From our data set, we are able to ascertain the sub-sector within which a firm operates (identified by the four-digit Vietnam Standard Industrial Classification (VSIC) code; the exhaustive list of the VSIC codes can be found in Prime Minister's Office (2018)), as well as the quantity produced by a firm in the last year (for its top three products). We use this information on the quantity (of its primary good) produced by the firm in the last year to identify whether a firm meets the threshold for production capacity that is relevant for a firm in that sub-sector to obtain the ESC. If a firm produces more than this threshold in even a single year (out of a maximum of three years), we code this dummy variable as taking the value 1.[9]

We are able to approximately match almost all the sub-sectors in our data set with those listed in The Government of Vietnam (2015), except one sub-sector, namely "manufacturing of other food products: n.e.c", which comprises about 17% of the observations in our regression sample. We were not able to find a corresponding match for this sub-sector, and thus unable to determine the threshold. To be conservative, we choose to code the dummy for compliance

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[8]The maximum value of the total labour force among the 2216 observations in our main estimation sample is 280.

[9]While we have information on the quantities and units of production for most firms, we were not able to translate the units into English for some of the observations. In other cases, we had to make assumptions to convert the units mentioned in the database to those used to define thresholds in (The Government of Vietnam, 2015). For instance, some firms producing beverages in our data set reported production in terms of boxes of product, while the threshold is defined in terms of litres. In such cases, we made suitable assumptions to identify which firms may meet the thresholds.

as one for all large firms in this sub-sector, based on the size of their total labour force. Thus, we code this dummy as 1 if a firm belonging to this sub-sector employs more than 6 workers (which is the median number of workers in our data sample over all firms).[10] The dummy variable takes the value of '1' for about 17% of the observations in our regression sample (for 379 out of 2216 observations). We are also able to confirm the main results of the paper (provided in columns (1) and (3) of Table 3) by dropping all observations for which this dummy takes the value 1 (results can be provided on request).[11]

To capture any residual effects on adoption of the ESC due to mandatory compliance by firms, in all our estimations, we include dummy variables for each sub-sector within the food and beverage industry where firms are required to obtain the ESC. In order to control for firm size, we include the total labour force of the firm as a control variable in all regressions.

The geographical coverage of our study is nine provinces of Vietnam, from three different regions, the north (Hanoi, Phu Tho, and Hai Phong), south (Ho Chi Minh City, Long An, and Khanh Hoa), and central (Nghe An, Quang Nam, and Lam Dong), including some of the most important manufacturing centers of the country (such as Ha Noi, Hai Phong, Quang Nam, Ho Chi Minh City, and Long An). The survey is representative at the province level (Sharma and Tarp, 2018). In this paper, we focus our analyses on the food and beverage industry, which is one of the most important industries in Vietnam, and also the largest in terms of sample size in our data set (it comprises 34% of the total observations).

Table 1 below provides summary statistics on the main explanatory variables, as well as on the dependent variable, for the regression sample. While about 17% of the firm-year observations suggest having received the certification for meeting environmental standards, about 59% of respondents in our data sample said that they had no knowledge of the LEP, or didn't care about it, i.e. paid limited attention to it. About 77% of the respondents were owners, and 51% of them were male. The average age of the respondent is about 48 years in our sample. However, the share of respondents who were college-educated was fairly low, at about 19%. About 83% of respondents rely on the income or profits from the firm as their main source of household income.

Importantly, our data set also contains information on whether the firm was inspected for various reasons (technical reasons such as environmental compliance or for fire-safety, policy-related reasons such as labor code or tax law violations, or other reasons, such as after accidents). We control for enforcement, by using a lagged indicator of the total number of technical inspections. Specifically, our variable captures the median of the lag of number of technical inspections over all firms other than firm 'i' at the district level. Thus, we create a measure of the average number of lagged inspections at the district level for all firms excluding the firm in question, so as to avert endogeneity concerns, and ensure that we control for the monitoring efforts. We find that the mean of this variable is 0.13 for our regression sample.[12]

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[10]We also used other values for the size of labour force to determine this cut-off, and were able to confirm the results of at least the probit estimation in column (1) of Table 3 for all other values. We also attempted dropping this sub-sector from our analysis, and in this case we were also able to confirm the probit results of column (1) of Table 3. While we also tried estimating the recursive bivariate models in columns (2) and (3) of Table 3 using varying cut-offs, as well as by dropping this sub-sector from our data set, we were unable to achieve convergence in these estimations.

[11]We were not able to confirm the results of column (2) of Table 3, due to a lack of convergence of the model.

[12]While taking the lag of the number of inspections would have implied a significant loss in observations,

Table 1: Summary statistics for the regression sample

Variable	Mean	Std. Dev.	Minimum	Maximum
Certification for meeting environmental standards	0.167	0.373	0	1
Paid limited attention to LEP	0.591	0.492	0	1
Whether respondent is owner	0.773	0.419	0	1
Whether respondent is male	0.509	0.500	0	1
Age of the respondent	47.666	10.666	17	89
Whether respondent is college educated	0.185	0.388	0	1
Whether profit/income from firm is the main source of household income	0.829	0.376	0	1
Median number of inspections at the district level	0.132	0.402	0	2
Age of the firm	16.768	10.563	2	76
Whether firm is a household enterprise	0.825	0.380	0	1
Total labor force of the firm	8.843	20.520	1	280
Whether firm has certificate of land use right	0.799	0.401	0	1
Whether firm has multiple owners	0.072	0.259	0	1
Whether firm has internet access	0.188	0.391	0	1
Number of personal computers owned	0.755	3.053	0	98
Current (within district) market share	37.369	42.398	0	100
Whether firm has ever paid a bribe	0.305	0.461	0	1
Whether firm exports	0.035	0.184	0	1
Whether firm produces more than one good	0.069	0.254	0	1
Whether firm faces competition in its field of activity	0.839	0.368	0	1
Whether firm had labor disputes in the last two years	0.001	0.037	0	1

Notes: Summary statistics are calculated for the regression sample of columns (2) and (3) of Table 3, using 2216 observations. This regression sample includes firms in the food and beverage industry that did not change either location or industry of operation over the three years of the sample (2011, 2013 and 2015) and had manufacturing as the main production sector.

The average age of the firm in our sample is about 17 years, suggesting that these firms are not very young, on average. About 82% of these businesses are run as household firms, with an average total labor force size of about 9 workers per firm. 80% of firms have the certificate for land use right, namely the right to use the land (since private ownership of land is forbidden in Vietnam). About 93% of firms have a single owner, while about 19% of firms have access to the internet, with firms owning about one computer on average. The mean district-level market share of these firms is about 37%.

About 31% of the respondents admitted to having paid bribes for some reason related to the business. Corruption and bribery, especially in the form of "grease money" to fulfil basic tasks and services, is rampant in Vietnam (Bai et al., 2019). While it is unknown whether the firms in our sample paid bribes in order to get the certification, or to avoid getting it, it is likely to be a determinant of the certification process for firms in Vietnam. About 4% of firm-year observations consist of firms that export, while about 7% comprised firms that had diversified their product base (i.e. produced more than one good). A very large share of firms (about 84%) said that they faced competition in their field of activity. About 0.14% of respondents admitted to have had a labor dispute within the firm in the past two years.

Table 2 presents some additional statistics on levels of certification for environmental standards, as well as on the levels of awareness on the LEP for the respondents. The average certification

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given that we would have no values for this variable for 2011, we were able to link our data set to a previous version of this survey which was conducted in 2009, and collected information on inspections. We were able to match most firms in our 2011 sample to the 2009 data set, and thus, we do not end up losing a significant number of observations (out of a total of 748 firms in the food and beverage industry in 2011, we found information on inspections for 610 firms from the 2009 data set).

Table 2: Summary statistics of important explanatory variable across groups

Category	Obs.	Certified	Have knowledge of LEP	Total labor force	College-educated	Inspections	Bribed	Exported
Have knowledge of LEP	907	0.281		14.840	0.314	0.190	0.447	0.066
Paid limited attention to LEP	1309	0.087		4.688	0.096	0.092	0.207	0.014
Certified	369		0.647	26.041	0.460	0.251	0.509	0.149
Uncertified	1847		0.309	5.407	0.130	0.108	0.264	0.012

Notes: Summary statistics are calculated for the regression sample of columns (2) and (3) of Table 3, using 2216 observations. This regression sample includes firms in the food and beverage industry that did not change either location or industry of operation over the three years of the sample (2011, 2013 and 2015) and had manufacturing as the main production sector. All variable means are significantly different for firms that had knowledge of the LEP (compared to those that didn't pay attention to it) at the 1% level. Similarly, all variable means are significant different for firms that were certified, versus those that were not certified, at the 1% level.

rate was about 8.7% for firms that paid limited attention to the environmental law, compared to 28% for firms that were aware of it to some extent. On average, the firms that had some awareness were slightly larger (with an average of 15 employees), while firms with limited attention had about 5 employees. Inattentive respondents were less likely to be college-educated (only about 9.6% of them are college-educated), compared to 31.4% of respondents with some awareness of the LEP who were college-educated. Firms where respondents were aware were also located in districts where more inspections had taken place (even though the absolute number is rather low), suggesting that inspections may be a means to bring the law and its requirements to the attention of respondents. Interestingly, the share of respondents having paid bribes was more than double for firms with some knowledge of the LEP (45%), compared to those that paid limited attention to it (21%). Firms where respondents were aware of the LEP were also more likely to export (6.6%, compared to 1.4% for those firms where respondents had paid limited attention to the LEP). Note that these variable means are all significantly different between respondents who had paid limited attention, and those that had some knowledge of the LEP, at the 1% level.

Firms that received the environmental standards certificate were less likely to have owners/managers paying limited attention to the LEP (31%) compared to firms that did not have the certification (65%). Likewise, firms that received certification were likely to be larger (an average of 26 employees, compared to 5 employees at firms that have not received certification). Certified firms were also more likely to have college-educated respondents (46% versus 13%), and more likely to have been inspected in the past as well compared to non-certified firms. They were more likely to have paid bribes (about 51% versus 26% of non-certified firms). Lastly, 15% of firms that received certification exported, whereas only 1.2% of those without certification end up exporting. Again, the variable means are all significantly different between respondents who worked at firms that had been certified, and those that were not, at the 1% level.

The close association between awareness and certification can also be seen in Figure 1, which plots the distribution of the levels of attention paid by respondents to the LEP in our sample over the two categories of certification status, namely firms that have not received a certificate, versus those that have. There appears to be a very clear association between limited attention, and not having received certification (the distribution of non-certified firms is heavily concentrated in the category of those that "have no knowledge of or interest in the LEP"), whereas the difference is more subtle for those firms that have received certification.

In Figure 2, we plot the proportion of respondents that have paid limited attention to the

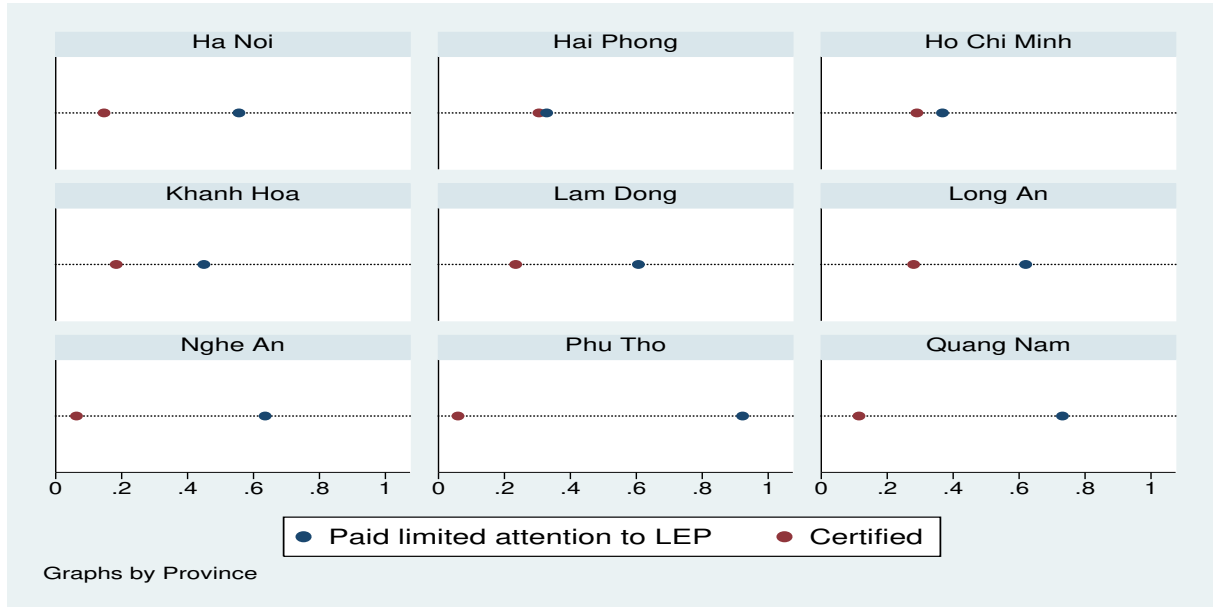**Figure 1:** Association between awareness and certification at the overall level
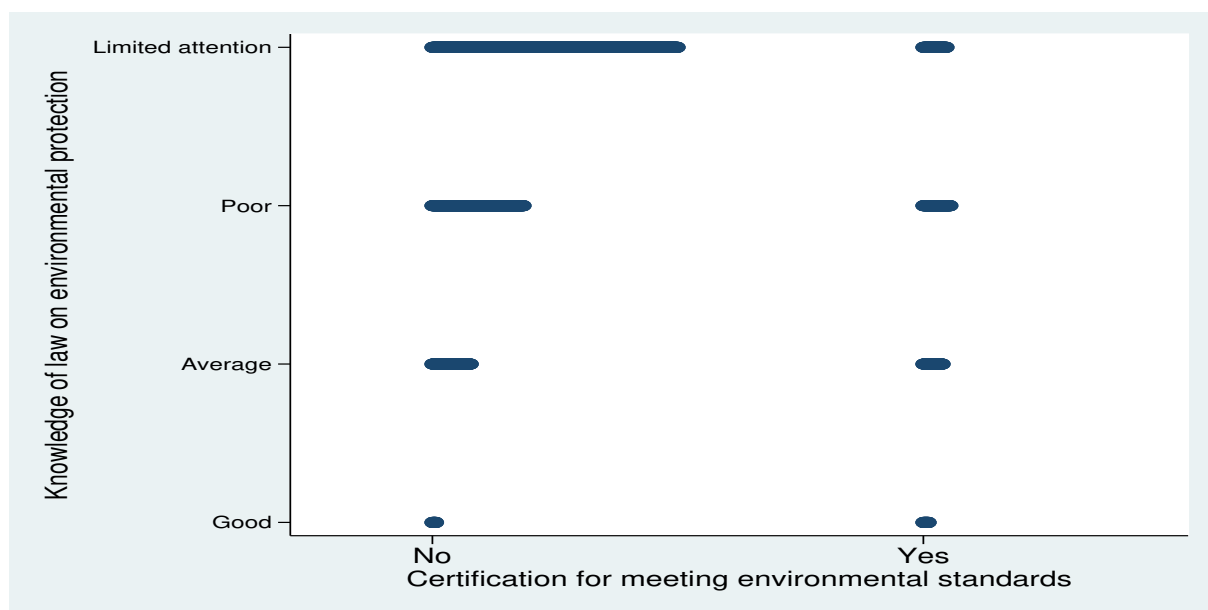
Notes: Source: UNU-WIDER Vietnam Database. The plot uses data of the regression sample of columns (2) and (3) of Table 3, using 2216 observations. The regression sample includes firms in the food and beverage industry that did not change either location or industry of operation over the three years of the sample (2011, 2013 and 2015) and had manufacturing as the main production sector.

LEP, as well as the environmental certification rates, across provinces in our sample of firms in the food and beverage industry. We see wide heterogeneity in both levels of awareness and certification levels across provinces. For instance, in Phu Tho, we find that both are rather low (6% of the firms have received certification, versus 92.24% were inattentive to the LEP). On the other hand, in Ho Chi Minh City, about 37% of firms had respondents who had paid limited attention to the LEP, and 29% of firms were certified. In general, it is clear that provinces that have higher levels of attentivity/knowledge of the LEP also have higher levels of certification. While these are just correlations, they still provide descriptive evidence on our main hypothesis.

Table 6 in the appendix presents summary statistics on our instrumental variable, namely the index that we created to denote the skill level of the respondent's parents' occupations. This index is generated as the sum of the skill level of the respondent's mothers' and fathers' occupations. Panel A presents summary statistics on these individual indices for the mothers and fathers respectively. The left-hand column presents different categories of occupations, along with the value taken by the index for these occupations in brackets. More skilled jobs take lower values (e.g. the respective indices take the value of "1" if the parent works in a management role), whereas lower skilled jobs take higher values (e.g. the respective indices take the value of "5" if the parent works as an unskilled worker).

We find that a larger share of the respondent's mothers are in higher skill occupations than fathers. About 77% of respondent's mothers are unskilled workers, compared to 84% with fathers who are unskilled workers. Panel B presents the distribution of the sum of the two

Figure 2: Association between awareness and certification at the province-level

Notes: Source: UNU-WIDER Vietnam Database. The plot uses data of the regression sample of columns (2) and (3) of Table 3, using 2216 observations. The regression sample includes firms in the food and beverage industry that did not change either location or industry of operation over the three years of the sample (2011, 2013 and 2015) and had manufacturing as the main production sector.

indices denoting mother's and father's occupations (which we call the index of skill of parents' occupations). Thus, higher levels of this variable denote lower aggregate skill levels of the parents' occupations.

5 Results

5.1 Main Results

Table 3 below presents the main results of this paper. In column (1), we present the results of the estimation using the probit methodology, column (2) includes the results of the recursive bivariate model, whereas column (3) includes the results of the recursive bivariate model using the Mundlak/Chamberlain adjustment to address unobserved heterogeneity. Table 3 presents the coefficients of these estimations. All estimations include province and year fixed effects, a dummy to denote the firms that we identified as needing to obtain the ESC on a mandatory basis, as well as dummies for sub-industries where large firms are required to obtain the ESC, and report robust standard errors. Note that the null hypothesis for zero correlation between the error terms in the first and second stages of the estimations in columns (2) and (3) of Table 3 can be rejected at the 1% level for the model in column (2), and at the 5% level in column (3), using a Wald test (which provides support in favor of the recursive bivariate methodology).

The probit results of column (1) reveal that paying limited attention to the LEP (captured by having no knowledge about it, or no interest in it) is negatively associated with the likelihood of receiving certification for meeting environmental standards. The coefficient is significant at the 1% level. This finding is in line with our intuition. Receiving certification is also positively associated with firm size (firms having a larger workforce are more likely to be certified), and with exporting behavior, which is also expected. Access to information technology is another positive determinant of the likelihood of getting certification, with firms that have internet access and more computers being more likely to be certified, than those that do not have internet access, or less computers. The results of column (1) suggest that college-educated respondents and those for whom profits (or salaries) from the firm are the main source of income are more likely to be working in firms that have received the certification.

Lastly, firms that are household-run enterprises (as opposed to proprietorships, partnerships, limited liability companies, or joint stock companies without state capital) are less likely to receive certification, as are firms that are diversified in their production (i.e. produce more than one good). Household enterprises may face higher costs of obtaining voluntary certification, given that they are often smaller, and pollution control may be expensive for them even if they were aware of the regulation. Secondly, household firms are also less likely to be monitored for meeting mandatory requirements, i.e. the enforcement efforts are likely to be weaker for them. This implies they may not have information on the law, compared to other firms that have been monitored, and thus they may be more inclined towards not obtaining environmental certification.

In columns (2) and (3), we present the results of the second-stage models of the recursive bivariate estimations. We find that paying limited attention to the LEP still has a negative effect on the likelihood of receiving certification in the results of column (2) where we attempt to address endogeneity, and that this variable is again significant at the 1% level. We also confirm some of previous findings about the control variables. For instance, in the results of column (2), we still find that firms that export are more likely to receive certification, as are firms that have more computers. Household firms are less likely to receive certification, as in the results of column (1). Also in line with the results of column (1), respondents who answer that firm profit or income is the main source of income for their household are more likely to be working in firms that have received certification. This is intuitive, and implies that both owners and managers who work primarily at the firm have stronger incentives to ensure that the firm receives certification.

The results of column (3) support our most important finding about the role of being attentive to the LEP on the likelihood of receiving certification, with the variable capturing limited attention of owners/managers having a coefficient of slightly smaller magnitude than in column (2), and retaining significance at the 1% level. Thus, we find that the negative effect of limited attention on the certification likelihood is persistent, even when we attempt to address concerns of unobserved heterogeneity. With the Mundlak/Chamberlain adjustment and the inclusion of averages of time-variant variables, we find that some controls that were significant in previous models are no longer significant in the results of column (3). However, we find that firms that have paid a bribe in the past for whatever reason are less likely to have been certified. One explanation may be that a bribe in this context can be seen as a means to avoid receiving certification. On the other hand, firms may also be paying bribes to expedite receiving certification, with the implication that this result may represent some firms having paid bribes,

Table 3: Main results: second-stage estimations

Dependent Variable: Whether certified Column	Probit (1)	Recursive bivariate (2)	Recursive bivariate with Mundlak correction (3)
Paid limited attention to LEP	-0.272	-1.320	-1.235
	(0.083)	(0.355)	(0.411)
Median number of inspections at the district level	-0.108	-0.161	-0.210
	(0.108)	(0.102)	(0.126)
Whether respondent is owner	-0.102	-0.082	0.047
	(0.097)	(0.090)	(0.158)
Whether respondent is male	0.086	0.025	-0.097
	(0.080)	(0.077)	(0.152)
Whether firm has certificate of land use right	0.032	0.028	-0.071
	(0.099)	(0.094)	(0.204)
Whether respondent is college educated	0.318	0.156	0.244
	(0.109)	(0.116)	(0.212)
Whether firm has ever paid a bribe	0.028	-0.046	-0.196
	(0.088)	(0.087)	(0.118)
Whether firm exports	0.550	0.461	0.616
	(0.209)	(0.206)	(0.428)
Whether firm produces more than one good	-0.295	-0.216	-0.300
	(0.166)	(0.153)	(0.243)
Current (within district) market share	0.0002	0.0002	0.0009
	(0.001)	(0.001)	(0.001)
Number of personal computers owned	0.018	0.019	0.077
	(0.011)	(0.012)	(0.035)
Whether firm faces competition in its field of activity	0.198	0.090	-0.027
	(0.124)	(0.122)	(0.170)
Whether firm had labor disputes in the last two years	0.375	0.292	0.062
	(0.423)	(0.453)	(0.692)
Whether profit/income from firm is the main source of household income	0.329	0.282	0.121
	(0.129)	(0.121)	(0.175)
Whether firm has multiple owners	0.193	0.137	-0.345
	(0.158)	(0.154)	(0.284)
Whether firm is a household enterprise	-0.491	-0.362	-0.336
	(0.133)	(0.136)	(0.405)
Total labor force of the firm	0.005	0.003	-0.007
	(0.003)	(0.003)	(0.005)
Age of the respondent	0.0004	-0.001	0.001
	(0.004)	(0.004)	(0.009)
Age of the firm	-0.002	-0.002	0.002
	(0.004)	(0.004)	(0.014)
Whether firm has internet access	0.239	0.073	-0.321
	(0.120)	(0.138)	(0.216)
Observations	2174	2216	2216
Wald test-statistic of rho = 0		5.076	3.619
P-value		0.024	0.057

Notes: Dependent variable is a binary variable denoting whether the firm has been certified for meeting environmental standards. Estimation results of columns (2) and (3) are the second-stage results, corresponding first-stage results are provided in Table 4. All specifications include province and year fixed effects, as well as dummies for sub-sectors where certification is mandatory. The specification in column (3) includes time-averages of all exogenous variables having positive within variation. Regression sample comprises food and beverage industry firms with manufacturing as the main production sector that do not change their location or industry of operation over the duration of the sample. Huber-White standard errors are reported in parentheses. The coefficients of the constant are not reported.

but not yet having received certification. It is difficult to pinpoint the exact channel, in the absence of further information on the reason for which the bribe was paid.

Moreover, firms that belong to districts where more technical inspections have previously taken place are less likely to be certified as well. This suggests that there may be clusters of firms in certain districts that have not been adopting environmental certification, despite some firms having been inspected. In consistency with previous results though, having more computers continues to remain a significant positive determinant of the likelihood of receiving certification for meeting standards.

In Table 4, we present the results of the first-stage estimations corresponding to the results of columns (2) and (3) of Table 3, with column (1) of Table 4 corresponding to the recursive bivariate model, and column (2) to the recursive bivariate model with the Mundlak/Chamberlain adjustment. In the results of column (1), we find that lower skill levels of the parents' occupations

(i.e. higher values of this index) are positively associated with the respondents paying limited attention to the LEP, controlling for respondent-level education. This is in line with our expectation. Moreover, male respondents and college-educated respondents are more likely to be attentive to the LEP, as are older respondents. We also find that firms that have paid a bribe are more likely to have been attentive to the LEP (which, combined with the results of Table 3, suggests that firms may be paying bribes as grease money to receive certifications quicker), as have those with internet access. On the other hand, we find that firms belonging to more competitive sectors are more likely to be knowledgeable of the LEP, as are firms having a larger workforce.

The results of column (2) partially support the results of column (1), with the difference being that fewer control variables are significant once we include the time averages. For instance, our instrumental variable (skill levels of the parents) still has a significant effect on the likelihood of the respondent having been inattentive to the LEP, with the expected sign (respondents whose parents worked in lower skill jobs were more likely to lack knowledge of the LEP). The result on bribery still persists, with firms that bribed being more likely to have paid some attention to the LEP, as is the case for firms that operate under competition. We also find that firms that have multiple owners were more likely to be have been aware of the LEP, which is also somewhat intuitive. Lastly, the previous result on the negative effect of internet access on the likelihood of respondents having limited attention is also confirmed in column (2).

Table 5 presents the marginal effects for some important explanatory variables drawn from the three estimation results presented in Table 3. Note that the marginal effects for the explanatory variables in columns (2) and (3) represent the direct effect of these variables on the likelihood of being certified. We find that firms where respondents had paid limited attention to the LEP were 5 percentage points less likely to obtain certification for meeting environmental standards, than firms where respondents had some knowledge or interest in the law, according to the results of the marginal effects for the probit estimation in column (1).

The size of this effect increases once we control for endogeneity in column (2), where we find that limited attention of owners/managers to the LEP resulted in firms being 33 percentage points less likely to obtain certification for meeting environmental standards, than firms where respondents had some knowledge of it. In column (3), we find the magnitude of this marginal effect to be 30 percentage points, once we include the time averages. Thus, we show that controlling for endogeneity may be significant in this context. Moreover, while the use of the recursive bivariate framework can enable us to interpret these effects as causal, given that we were not able to achieve convergence using this methodology in certain estimations involving a specific sub-sector (refer to Footnote 11), we choose to be conservative and interpret them as providing suggestive evidence on the role of limited attention in determining certification.

We also list the marginal effects for some other important controls in Table 5. We find that in line with the results on the coefficients presented in Table 3, firms with college-educated respondents (owners or managers) and firms that export, are 6 percentage points and 10 percentage points more likely, respectively, to be certified for meeting environmental standards (column (1)). Owning one more computer is also positively associated with the firm receiving certification (an additional computer raises the likelihood of receiving certification by 1.3 percentage points, according to column (3)), while household enterprises are less likely to be certified (6.4 percentage points less likely, according to column (2)). Lastly, firms that belong to districts where more technical inspections took place in previous years are 3.5 percentage

Table 4: Main results: first-stage estimations

Dependent Variable: Whether aware of LEP Column	Recursive bivariate (1)	Recursive bivariate with Mundlak correction (2))
Index of extent of unskilled occupations of parents	0.049	0.047
	(0.025)	(0.025)
Median number of inspections at the district level	-0.143	-0.036
	(0.095)	(0.114)
Whether respondent is owner	0.048	-0.028
	(0.079)	(0.133)
Whether respondent is male	-0.208	-0.137
	(0.063)	(0.128)
Whether firm has certificate of land use right	-0.052	-0.039
	(0.082)	(0.163)
Whether respondent is college educated	-0.324	-0.118
	(0.094)	(0.180)
Whether firm has ever paid a bribe	-0.214	-0.240
	(0.072)	(0.098)
Whether firm exports	0.153	-0.099
	(0.243)	(0.449)
Whether firm produces more than one good	0.059	0.222
	(0.124)	(0.197)
Current (within district) market share	0.0007	-0.0002
	(0.0008)	(0.001)
Number of personal computers owned	0.003	0.003
	(0.012)	(0.014)
Whether firm faces competition in its field of activity	-0.356	-0.325
	(0.091)	(0.130)
Whether firm had labor disputes in the last two years	-0.229	-1.356
	(0.773)	(0.908)
Whether profit/income from firm is the main source of household income	-0.058	-0.080
	(0.086)	(0.137)
Whether firm has multiple owners	-0.095	-0.531
	(0.158)	(0.284)
Whether firm is a household enterprise	0.086	0.179
	(0.129)	(0.399)
Total labor force of the firm	-0.013	-0.006
	(0.003)	(0.007)
Age of the respondent	-0.007	-0.0008
	(0.003)	(0.008)
Age of the firm	-0.001	0.005
	(0.003)	(0.015)
Whether firm has internet access	-0.352	-0.345
	(0.106)	(0.203)
Observations	2216	2216

Notes: Dependent variable is a binary variable denoting whether the respondent paid limited attention to the LEP. Estimation results are the first-stage results, corresponding second-stage results are provided in columns (2) and (3) of Table 3. All specifications include province and year fixed effects, as well as dummies for sub-sectors where certification is mandatory. Specification in column (2) includes time-averages of all exogenous variables having positive within variation. Regression sample comprises food and beverage industry firms with manufacturing as the main production sector that do not change their location or industry of operation over the duration of the sample. Huber-White standard errors, are reported in parentheses. The coefficients of the constant are not reported.

Table 5: Marginal effects of important explanatory variables

Dependent Variable: Whether certified Column	Probit (1)	Recursive bivariate (2)	Recursive bivariate with Mundlak correction (3)
Paid limited attention to LEP	-0.050	-0.332	-0.297
	(0.015)	(0.135)	(0.145)
Whether respondent is college educated	0.058	0.028	0.041
	(0.020)	(0.019)	(0.035)
Whether firm exports	0.100	0.082	0.103
	(0.038)	(0.037)	(0.071)
Number of personal computers owned	0.003	0.003	0.013
	(0.002)	(0.002)	(0.006)
Whether firm is a household enterprise	-0.089	-0.064	-0.056
	(0.024)	(0.022)	(0.066)
Median number of inspections at the district level	-0.020	-0.029	-0.035
	(0.020)	(0.019)	(0.022)
Observations	2174	2216	2216

Notes: Dependent variable is a binary variable denoting whether the firm has been certified for meeting environmental standards. Marginal effects for some important explanatory variables (calculated at the dydx level) are presented, corresponding to the second-stage coefficients of Table 3. Marginal effects are calculated at means. Bootstrapping is used to calculate the direct marginal effect for the "Paid limited attention to LEP" variable in columns (2) and (3), run over 1000 iterations. All specifications include province and year fixed effects, as well as dummies for sub-sectors where certification is mandatory. Specification in column (3) includes time-averages of all exogenous variables having positive within variation. Regression sample comprises food and beverage industry firms with manufacturing as the main production sector that do not change their location or industry of operation over the duration of the sample. Huber-White standard errors are reported in parentheses. *,** and *** respectively denote significance at 10%, 5% and 1% levels. The coefficients of the constant are not reported.

points less likely to be certified themselves (as suggested in column (3)).

These results confirm our hypothesis regarding the importance of paying attention to the laws on whether a firm receives voluntary certification for meeting environmental standards. In the next subsection, we derive marginal effects over important subgroups of the data sample, to examine heterogeneities in the magnitude of the main effect.

5.2 Extensions

In Table 7 in the Appendix, we present some additional results based on our main estimation results of Table 3. We estimate whether the marginal effect of limited attention on certification for meeting environmental standards varies along different dimensions (such as province, time, education, etc.). We use the recursive bivariate probit estimation of column (3) of Table 3 to compute these heterogeneous marginal effects, given that it mitigates the concern of endogeneity, and it also attempts to address the problem of unobserved heterogeneity through the Mundlak/Chamberlain adjustment.

We find that the absolute value of the marginal effect of limited attention on the likelihood of certification is higher for firms with college-educated respondents, and those that export, i.e. firms that exported, or had college-educated owners or managers, were more likely to have obtained the voluntary certification if they had paid attention to the LEP, than firms that didn't have college-educated respondents, or didn't export. This confirms findings from previous studies on the role of education and exporting behavior in determining the adoption of voluntary certificates (Ervin et al. 2012; Tambunlertchai et al. 2013). We also find that negative effect of limited attention on certification is weaker for household enterprises, i.e.

household enterprises with owners or managers who were aware of the LEP were less likely to obtain certification than non-household enterprises. In line with our previous results, this may be due to household enterprises facing larger costs for adopting voluntary standards, or due to weaker enforcement efforts towards them (that may be a potential source of information for firms on the LEP).

Interestingly, we find that firms that have made informal payments, or bribed, are more likely to obtain certification if they are attentive to the LEP, than firms that have not bribed (based on the absolute values of the marginal effects). This provides further support in favour of our finding that paying bribes may be a means to push authorities to issue certificates for meeting environmental standards (rather than avoid getting the standards) to firms, and thus that the cost of getting certified may be higher for firms that have never bribed, i.e. it may be more difficult for them to obtain certification, even if they are aware of the LEP.

Finally, we find that the absolute value of the marginal effect of limited attention on the likelihood of certification is higher for firms that have been inspected at least once, i.e. firms that had been inspected at least once were more likely to obtain certification if they were attentive to the LEP (compared to firms that had never been inspected). This suggests that enforcement may be a suitable policy mechanism to both increase awareness of the LEP, but also increase the certification likelihood.

The value of the marginal effect of limited attention on the likelihood of being certified also varies across provinces, with the highest (negative) marginal effects observed in Hai Phong, Ho Chi Minh City (HCMC) and in Long An, which implies that firms in these provinces with owners or managers who were attentive to the LEP were more likely to have obtained environmental certification, than in other provinces. Moreover, we also find that the marginal effect varies over time, with the strongest effect observed in 2011 (firms with limited attention were 33 percentage points less likely to obtain environmental certification then), which declined to about 10 percentage points by 2015. As intuition suggests, with time, the effect of knowledge of the LEP on obtaining voluntary certification should weaken, as this finding suggests.

6 Conclusion and Policy Implications

Our study attempts to shed light on the role of limited attention paid by owners and managers of firms to the Law on Environmental Protection, on the likelihood of voluntarily obtaining certification for meeting environmental standards in the food and beverage industry in Vietnam. We find that firms where owners and managers paid limited attention to the law were 30 percentage points less likely to be certified for meeting environmental standards, while controlling for measures of enforcement which have traditionally been found to be important in the economic literature, and accounting for firms that needed to obtain certification (on a mandatory basis).

Moreover, firms where the owners or managers are college-educated, that export goods, and that have previously been inspected for technical reasons such as environmental violations, are more likely to be certified if they have been attentive to the LEP, suggesting that education, international linkages, and traditional enforcement mechanisms like monitoring may be playing an important role in incentivizing firms to get certified in this context (in line with the previous literature). This effect, however, is weaker for firms that are household enterprises, because the

cost of compliance may be higher for them (and levels of enforcement are also likely be lower). Interestingly, we also find that firms that have bribed are more likely to obtain certification if their owners/managers had been attentive to the LEP (as opposed to firms that had never bribed). Thus, bribing may be seen as a form of grease money payment in this particular context, in line with other studies (Bai et al., 2019).

The results also highlight which segment of the population is more likely to be have paid attention to the regulations. For instance, given that firms with internet access are more likely to be aware of regulations, policy-makers may benefit from targeting information and education campaigns to those firms that lack internet access, to owners of businesses who are not very educated, or to household enterprises. Our results also suggest that firms with multiple owners, or those that faced competition from other firms in their field of activity, were also more likely to be have knowledge of the LEP, as were larger firms. Thus, smaller firms may need further incentives to adopt voluntary standards in the absence of access to information on them.

The key takeaway from our study is that addressing the behavioral anomaly of limited attention, and thereby ensuring that firm owners and managers have knowledge of the laws and understand them, may be a critical determinant of ensuring that firms participate in voluntary programs, especially in contexts where institutions are weak and factors such as corruption may incentivize violations on part of firms.

Our results have important policy implications in the context of Vietnam. Given that the food and beverage industry has the highest pollution load in Vietnam (Dore et al., 2008), the findings of this study are very relevant for policy-makers looking for low-cost solutions to ensure greater environmental compliance. While traditional enforcement and implementation tools remain important, bringing to salience information on laws and regulations should be a complementary policy measure to ensure that firms have no information constraints to abide with laws, even for inducing the voluntary adoption of policies such as certificates or environmental standards. Of course, it remains to be seen whether these results are applicable to firms belonging to other industries.

Somanathan (2010) highlights the importance of using information policies along with regulations to improve environmental quality in developing countries. While firms may continue evading adoption of policy instruments if the benefits of doing so exceed the costs, bringing laws and their requirements to salience has the potential, as our study shows, to make it more economically viable for firms to obtain voluntary certificates, by relaxing their information constraints.

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Appendix

Table 6: Distribution of the index of skills of parent's occupations

Panel A: Index of skills of mother and father's occupations		
No of obs. by category	Mother	Father
Management (1)	46	16
Higher educated professional worker (2)	26	14
Medium educated professional worker (3)	46	23
Semi-skilled workers (4)	400	303
Unskilled workers (5)	1694	1854
Total observations	2212	2210
Panel B: Sum of indices of mother's and father's occupations		
Sum of indices	Observations	
2	9	
3	4	
4	13	
5	25	
6	43	
7	29	
8	277	
9	143	
10	1673	
Total observations	2207	

Notes: Semi-skilled workers include office and customer service workers, sales and security workers, agricultural workers, production workers, operator and installation workers, and members of the army. In case the value for one of the two individual indices in Panel A is missing, the sum of the the indices of parents' occupations takes the value of the non-missing index. Distributions are derived for the regression sample of columns (2) and (3) of Table 3. This regression sample includes firms in the food and beverage industry that did not change either location or industry of operation over the three years of the sample (2011, 2013 and 2015) and had manufacturing as the main production sector.

Table 7: Heterogeneous marginal effects

Binary variables			Province		Year	
Whether firm exports	No	-0.187	Ha Noi	-0.298	2011	-0.325
		(0.093)		(0.132)		(0.133)
	Yes	-0.388	Phu Tho	-0.018	2013	-0.241
		(0.147)		(0.016)		(0.110)
Whether respondent is college-educated	No	-0.151	Ha Tay	-0.170	2015	-0.099
		(0.080)		(0.093)		(0.061)
	Yes	-0.462	Hai Phong	-0.414		
		(0.161)		(0.155)		
Whether firm is a household enterprise	No	-0.492	Nghe An	-0.122		
		(0.164)		(0.072)		
	Yes	-0.136	Quang Nam	-0.186		
		(0.075)		(0.095)		
Whether firm paid a bribe	No	-0.145	Khanh Hoa	-0.290		
		(0.078)		(0.130)		
	Yes	-0.370	Lam Dong	-0.347		
		(0.144)		(0.147)		
Whether firm was inspected	No	-0.136	HCMC	-0.400		
		(0.075)		(0.151)		
	Yes	-0.286	Long An	-0.384		
		(0.123)		(0.148)		

Notes: Dependent variable is a binary variable denoting whether the firm has been certified for meeting environmental standards. Marginal effect of awareness on being certified is calculated over some binary variables, province, and year (at the dydx level), corresponding to the second-stage coefficient of column (3) of Table 3, using 2216 observations. Marginal effects are calculated at means. Specification of column (3) of Table 3 includes province and year fixed effects, dummies for sub-sectors where certification is mandatory, and time-averages of all exogenous variables having positive within variation. Regression sample comprises food and beverage industry firms with manufacturing as the main production sector that do not change their location or industry of operation over the duration of the sample. Huber-White standard errors are reported in parentheses. The coefficients of the constant are not reported.

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