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RESEARCH ARTICLE

Licensing Scheme in the Green Industry Sector: The Case of Georgia Tree Care Service Providers

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Abstract
Tree care license requirements are expected to improve service quality and provider competencies. The study elicits the licensing fee Georgia firms would pay using survey data from 153 tree care firms. An empirical relationship identifies firm characteristics that influence the fee size using the inverse hyperbolic sine transformation function. Results show that respondents who propose higher annual licensing fees are on average younger, more educated, male, and likely to agree that mandatory licensing is necessary to establish professionalism in the tree care industry. Also, those often engaged in tree trimming services and firms with higher annual revenues contemplate paying higher licensing fees.

Keywords: firm attribute elasticity; inverse hyperbolic sine transformation; licensing fee; log-transformation; respondent attribute elasticity

JEL classifications: J44; L51

1. Introduction

The landscape maintenance sector encompasses arborist services and tree care. Tree care companies represent a specific segment of landscape maintenance and installation firms. The firms are also considered a part of the urban forestry sector which is estimated to contribute $35 billion annually to the US economy (Thompson, Herian, and Rosenabum, 2021). Tree care firms provide a variety of services including tree trimming, removal, and stump grinding. Homeowners in urban and suburban areas are major consumers of tree care services. The residential tree trimming services account for 54.1% ($20.1 billion) of total sector revenues (IBISWorld, 2023).

Galvin (2006) reported that the majority of tree care firms advertising their services online were unlicensed and two out of five did not provide sufficient contact information. Such omissions could be associated with difficulties in settling disputes with homeowners (Galvin, 2006). Tree care firms are difficult to identify because they can be classified using four indicators in the North American Industry Classification System (Ball, Vosberg, and Walsh, 2020). The interest in tree care service provision is reflected in statistics published by the United States Better Business Bureau (BBB), which reported 897,905 inquiries about that type of service in 2022 (BBB, 2023). The quality of tree care services does not always meet customer expectations as the BBB also received 1,128 complaints concerning tree services. The number of complaints places the tree care sector in the top 3% in the number of all complaints among 6,236 industries listed.

A number of tree care firm owners and managers, who are members of the Georgia Arborist Association (GAA), opine that too often some tree care companies underperform, while individuals walking door-to-door and offering to trim trees, damage the reputation of established

tree care firms. The nature of tree care services allows for easy entry. Lack of insurance may prevent such firms from compensating a homeowner in case of tree care resulting in damage. Requiring an annual license would signal to the potential customer that the hired firm meets minimum professional standards. Several questions emerge from the views of GAA practitioners: how much are the tree care industry stakeholders willing to participate in a licensing scheme? Who in the tree care sector is likely to adhere to the licensing fee policy and to what extent are tree care firms ready to pay annual license fees? This paper aims at answering these questions and identifies the factors influencing the size of the annual licensing fee volunteered by representatives of tree care firms using data collected from tree care firms and members of the GAA. The study elicits the average annual fee firms volunteer to pay and specifies an empirical relationship to identify firm characteristics that influence the suggested fee size. The empirical specification includes attributes of the surveyed arborists responding on behalf of the tree care firm and quantifies effects of selected firm and respondent attributes associated with the size of the licensing fee. In other words, this research investigates the respondents' demographics and firm characteristics positively or negatively associated with the willingness to participate in a licensing scheme.

The study offers the first set of empirical evidence on the opportunities but also the potential hurdles related to establishing a licensing policy in the tree care industry, and contributes to the literature on licensing fees and the mandatory occupational licensing. Beyond the scope of tree care practitioners, from an occupational choice perspective, our research contributes to understanding the factors that might hinder or facilitate the decision to adopt a licensing fee within a particular profession. From a practical standpoint, answers to the aforementioned questions offer some avenues that can help GAA tree care practitioners improve the quality of their services by requiring minimum professional standards for all firms.

Some suggest that licensing requirements limit entry (Zapletal, 2019). However, in the case of a voluntary tree care firm license fee scheme, the goal is to enable the buyer of tree care services to differentiate a company capable of delivering quality services from those which emerge only in times of catastrophic weather events with attributes of a temporary business activity such as those with lax safety protocols, inadequate insurance, poor equipment, and insufficient knowledge and skills.

The commercial tree care sector operates in many countries as evidenced by the existence of arboriculture associations, for example, the Queensland Arboriculture Association, Inc., in Queensland, Australia (qaa.net.au, 2023), and the Belgian Arborist Association in Belgium (baas = isa.be/home-en/, 2023). Some of the national arborist associations are members of the International Arborist Association, which also operates several national chapters. The existence of such organizations reflects the demand from individuals residing in single-family dwellings in urban and suburban areas as well as commercial sector and municipalities. The state of Georgia is an example of a fast-growing region. Between 2010 and 2020, the state's population increased by 10.6% (1.024 million residents), and there were nearly 4.5 million housing units. The public space, for example, streets and parks, is served by municipal tree care departments funded by local budgets (e.g., McPherson et al., 2016; USDA, 2019). Knowledge from the current study of the tree care sector in Georgia is applicable to numerous southern states that have been witnessing fast population growth in recent decades, including Texas, Florida, North Carolina, South Carolina, Tennessee, and Virginia (census.gov, 2021).

Setting a fee is a crucial step in the implementation and viability of a licensing scheme for private tree care providers that aims at improving quality of performed services and preempts the imposition of mandatory programs by public entities. The regulations encompassing the tree care sector so far include occupational protocols and wood waste disposal as a part of waste handling ordinances. The current study quantifies the effects of firm and individual attributes on the size of the proposed annual license fee. Both groups of factors are important in a sector dominated by small, independently owned firms. Landscape maintenance and installation firms tend to be small and newly established firms employ an average of 3.7 workers (US Small Business Administration,

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2018). A survey of Maryland arborists reported that 67% of firms employed five or fewer workers (Galvin and Becker, 1998), while a later report confirmed that small tree care service firms are predominant nationwide (CDC, 2009). Those firms provide jobs to a local economy, while their services are also impactful on ameliorating effects of climate (McPherson et al., 2005).

The remainder of the paper is as follows: an informative section provides a detailed background on the tree care sector and licensing schemes, and the implications of occupational licensing for public interest. We then explain the methodological approach and describe the data obtained for this study. The next section presents and interprets the estimation results. Lastly, we offer concluding remarks.

2. Background

Homeowners in urbanized areas are a primary category of tree care firm customers. Home ownership typically involves a limited size landscape as an integral part of the property (Thostenson et al., 2017). Trees are an investment and well cared for trees can increase property values (Bradley, 2001; Kampf et al., 2007; Thompson, Herian, and Rosenabum, 2021). Thostenson et al. (2017) reported that 88% of homeowners planned to prune trees in the 5-year period following their survey, but only 39% planned to hire a tree care firm. Yet, the same group of respondents expressed the highest level of concern about trees or branches breaking and damaging the property and tree roots affecting the foundations, pipes, or pavement. Such problems require knowledge and equipment seldom available to a homeowner. Kuhn and Reiter (2009) found homeowners are unaware that tree care and proper tree trimming reduces weather-related power outages (Campbell, 2012). Kampf et al. (2007) suggest hiring tree care services to trim dead branches, or if a tree is located near power lines.

2.1. Quality tree care services

Following weather events causing tree damage, providers of tree care service emerge. "Door knockers" pose a risk to homeowners by potentially increasing the damage by incorrectly performed services (Bradley, 2001; Kampf et al., 2007). The "door knockers" who visit homeowners promptly following a weather-inflicted damage to trees are equipped only with a chainsaw and ladder. They may offer readily available services and, in some instances, can complete a job such as removing tree limbs blocking a private driveway. However, these opportunistic "door knockers" generally have limited knowledge of tree care, lack insurance to compensate customer for any damage, and do not carry workers' compensation insurance. Lack of knowledge, or not using personal protection equipment are responsible for fatalities in performing tree care (CDC, 2009). The 2017 Tree Care Industry Association (TCIA) report 129 occupational incidents (landscapemanagement.net, 2018), including nine in Georgia. About 57% of fatalities occurred in firms employing ten or fewer workers (CDC, 2009). The figures for accidents among "door knockers" are unknown since they may not even be registered as a company. In states requiring a license, such providers may operate illegally.

A solution proposed by some within the tree care sector involves a licensing scheme to assure a customer of a company's ability to provide quality care. Currently, homeowners seeking a tree care provider are advised to hire a licensed or certified company, verify personal and property general liability insurance, workers' compensation (Guetebler, 2022), and professional liability insurance to cover incidents resulting from negligence, mistakes, or omissions (McInerney, 2023). Worker's compensation insurance is mandated if a provider performs services on a tree taller than ten feet in Massachusetts and 12 feet in Minnesota (Guetleber, 2022) illustrating the diverse conditions across locations.

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2.2. Licensing schemes

2.2.1. Occupational licensing.

To assure quality service, the state agency granting a license often imposes minimum training requirements as a condition to protect customers. Carpenter et al. (2017) reported that obtaining a tree trimming license required 574 days, or 1.57 years, but did not provide details about the specifics of the required education. A state-issued license shows that the firm meets requirements to offer tree care services (McInerney, 2023). Beside quality, a reason behind the occupational licensing has been the creation of a barrier to entry that could limit competition and increase earnings of those licensed. A fee for an occupational license in the existing schemes averaged $325 (Carpenter et al., 2017). Those fees have been imposed by local or state regulators, while the GAA seeks a consensus on an appropriate annual fee. The GAA has offered training workshops, while the Georgia Extension Service has organized safety training programs for the tree care sector.

The breadth of occupational licensing varies across states. For example, Louisiana is one of the states with the largest number of licenses for a number of occupations. Georgia licensed 44 different occupations (Carpenter et al., 2017) and ranked 33rd in terms of their number among the fifty states. Occupational license is required for tree care providers in Florida and Missouri (McInerney, 2023). The licensing of tree trimmers in states which implement such a scheme is not related to tree care requirements and Carpenter et al., (2017) wonder what caused such inconsistency among states.

Some states require a tree care firm to operate under a contractor license. The requirement applies to firms in California, Hawaii, Nevada, North Carolina, Utah, and Washington. In Georgia, the "green industry" firms, including tree care providers, register annually with the State Department of Agriculture in Georgia. The registry includes producers of horticultural products and suppliers of landscape services, which could include tree care and is just one of many tasks in the state agency. Casual observations suggest that not all tree care providers register in the existing system. License for tree services is regulated by local and state governments and is not required in many locations. States issuing occupational licenses to tree care firms maintain databases allowing them to verify the status of tree care service providers.

2.2.2. State tree care firm regulations.

The tree sector firm licensing or certification is often voluntary (McInerney, 2023). However, tree care providers can be subject to sector-specific state-imposed regulations. Among others, five states, Louisiana, Maine, Connecticut, New Jersey, and Maryland have obligatory arborist licensing schemes. In those states, the licensing scheme has been assigned to various state government agencies (Table 1). The type of agencies suggests various approaches to licensing and the scope of regulation varies. For example, in Connecticut the regulations do not apply to tree removal.

Table 1 lists the fees charged in five states. The fee structure varies and distinguishes between the licensing fee and the fee charge for a mandatory examination (which is not required in Maine). In New Jersey a firm needs to pay a business registration fee of $200 for a

2-year period. The $240 license fee in Connecticut was the highest, and the lowest, $30 per year, was in Maryland.

Besides the above listed states, a number of other states require a license for providing tree care services. The variety of names reflects the different approaches and scopes of a license. The license is listed as "Arborist License" in Kansas, "Certified Arborist License" in Colorado and Wyoming, "Tree Surgery Licenses" in Alabama, Iowa, and Mississippi, "Tree Care Registry"" in Minnesota, or "Timber Operator License" in West Virginia (McInerney, 2023). Licensing sometimes requires certification by the International Society of Arboriculture (ISA) or TCIA. Such options stress the importance of professional organizations in assuring that the tree care firm is knowledgeable and able to safely provide quality services.

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Table 1. Characteristics of tree care firm licensing schemes

Characteristic	Maine	Connecticut	New Jersey	Louisiana	Maryland
Title	First Class Landscape Arborist, First Class Utility Arborist, Master Arborist	Arborist License	Licensed tree care operator (LTCO) or Licensed Tree Experts (LTE)	Arborist License & Utility Arborist License	Maryland Tree Experts
Applies to the Following:	Arboriculture work: leaving the ground for pruning or trimming, installing cabling or bracing, diagnosing and evaluating conditions of trees, and felling or taking down trees in developed areas.	Tree Health Care (does not apply to tree removal)	Tree pruning, repairing, brush cutting or removal, tree removal, stump grinding or removal, tree establishment, fertilization, cabling and bracing, lightning protection, consulting, diagnosis, and treatment of tree problems or diseases, tree management during site planning and development, tree assessment and risk management, and application of pesticides or any other form of tree maintenance.	Make recommendations or execute tree surgery type work including tree removal, pruning, trimming, cabling, fertilization and cavity work.	Anyone who receives compensation for making diagnoses, prescribing, and supervising the treatment for trees; or trimming, pruning, thinning, cabling, shaping, removing, or reducing the crown of trees.
Agency:	Department of Agriculture, Conservation and Forestry	Dept. of Energy and Environmental Education	New Jersey Board of Tree Expert under the Environmental Protection Department	Louisiana Horticulture Commission	Maryland Department of Natural Resources
Fees	$60-$110 for Exam	$200 for Exam, $240 Annual Registration	Exam-$100-$175, License Renewal Fee $150 per 2 years, Business Registration Fee $200 per 2 years	Exam Fee-$114, License Fee $100 per year	Exam Fee: $30 License Fee: $30 per year

2.2.3. Certification schemes.

Potential customers have been advised to ask a tree care firm for certification issued by an industry organization or proof of membership in a professional organization (Bradley, 2001; Wiseman and Koci, 2020). For example, GAA or the ISA are professional associations of tree care providers. ISA offers voluntary certification, which involves an exam (Guetebler, 2022). ISA requires a minimum of 3 years' experience of full-time work as an arborist, which drops to 1 year if one has a bachelor's degree. Additional documentation may be required. The certificate pertains to the recipient's demonstration of knowledge in tree safety, aerial rescue, and electrical hazards. The certificate is issued to a person and a tree care firm should have at least one certified worker. Certification does not guarantee a quality job, but is an indication of knowledge and skills and reduces the asymmetry of information (Zapletal, 2019).

A private certification scheme (e.g., ISA) that is not mandatory may be unlikely to impose an education requirement. There is a lack of formal educational programs designed for the tree care sector in technical schools or colleges in Georgia. The existing, mostly state-run tree trimming programs vary widely in the United States (Carpenter et al., 2017). Currently, certification requires both experience and tested knowledge. Competencies are developed in the tree care industry through workshops and on-the-job training, and through training programs offered by individual firms. Some opine that training did not lower the number of accidents, suggesting programs are ineffective (Vosberg, 2005), but training remains at the core of ISA certification and licensing in states where it is required. A review of several accidents in Georgia concluded that accidents result from a failure to use protective equipment, or from inadequate backup for workers (e.g., Klaus, 2019; WALB News Team, 2022). Such accidents are often caused by individual choices and inadequate attention on the part of foremen. Safe tree care practice bulletins (Rains et al., 2022) and workshops on safe chainsaw use and accident prevention are offered to tree care firms by the extension service personnel in Georgia but are not mandatory.

The idea of licensing considered by the GAA would be in addition to the register of horticultural (green industry) firms managed by the state department of agriculture and applied only to the tree care sector or firms offering tree care in their service portfolio. The fee is to be "per firm" rather than an occupational license issued to an individual. The firm operator would still determine the training requirements of workers. The licensing scheme would involve a publicly accessible database. The fee size enabling broad participation has to recognize a firm's ability to pay and information about the potential fees should originate from those firms. The licensing burden of existing, mostly state-run tree trimming programs vary widely in the United States (Carpenter et al., 2017, and Table 1). Linking the provision of tree care to broad environmental benefits can be advantageous. Tree care companies by trimming and pruning trees on homeowner properties assure tree health and stimulate greater tree productivity. The provided services have measurable external benefits to society. Improvement of air quality was viewed among the most important benefits of tree planting and care (Akbari, 2002; Thostenson et al., 2017) as is carbon sequestration, pollution mitigation, and runoff reduction valued at over $73 billion annually (Thompson, Herian, and Rosenabum, 2021). The top five states with the greatest gains in annual quality-of-life benefits from urban trees are Texas, Georgia, Florida, North Carolina, and Mississippi, about $32 billion (Thompson, Herian, and Rosenabum, 2021).

2.3. Occupational licensing, public consumption, and externalities

Occupational licensing has traditionally served as a justification for professionals in various fields to enhance the quality of services offered to consumers (Kleiner, 2000). The GAA tree care practitioners' desire to regulate their sector aligns with this long-standing pattern of professionals within an occupation advocating for regulation, with consumers being less frequently the driving force behind it (Cox and Foster, 1990; Maurizi, 1974). The main rationale for initiating an occupational licensing scheme, as highlighted in this research, is the asymmetric information on

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the quality of services provided to consumers. Consumers are often less informed than professionals about the quality of services that they receive, which can result in challenges when addressing disputes in instances of inadequate services, ultimately tarnishing the reputation of the profession.

The anticipated benefits of implementing such occupational licensing pertain to the provision of higher quality services to consumers, which, in turn, can lead to positive spillover benefits for the general public. While occupational licensing can be advantageous for both service providers and consumers by raising quality and enhancing the reputation of a profession, it frequently results in higher costs for consumers, translating into increased wages for professionals (Chi et al., 2017; Chung, 2022; Gittleman et al., 2018; Kleiner and Krueger, 2010, 2013; Kleiner and Vorotnikov, 2017; Kleiner and Soltas, 2023). The impact of increased prices on public consumption will vary based on income levels. Individuals with lower incomes are likely to reduce their usage of the service and seek lower-quality alternatives at more affordable rates, while those with higher incomes are expected to boost their demand for the service in response to the improved quality (Cox and Foster, 1990). Additionally, consumers may be enticed to undertake tree care tasks on their own, which can entail certain risks and the possibility of generating negative externalities for the broader community.

Occupational licensing and more stringent entry requirements may also pose an obstacle to new entries in the profession (Carpenter et al., 2015, 2018). This constraint on the number of qualified professionals can exacerbate the increase in expenses for consumers, without a guaranteed enhancement in service quality (Blair and Chung, 2019; Cox and Foster, 1990; Maurizi, 1974). For instance, in areas of high demand, the service delivery time consumers receive may significantly increase. As the demand for tree care service far exceeds the supply of practitioners, homeowners may find it difficult to book licensed practitioners, ultimately generating some externalities for the communities, particularly in the case of emergency tree care service (e.g., fallen trees on public ways or other public hazards). Therefore, interventions play a crucial role in ensuring that licensing regulations achieve their intended objectives without causing significant harm to the welfare of both producers and consumers.

3. Empirical approach

This section investigates the factors explaining tree care firms' readiness to pay the annual licensing fee. The outcome variable is the size of the licensing fee the firm volunteers to pay annually. Managing costs in a tree care firm is associated with the desire to acquire equipment (Deering, 2005), but for a firm with limited resources even a licensing fee can be viewed as unnecessary. Therefore, recognizing the possible cost of the fee for a tree care firm, many of which are small, we specify the license fee as "per employee" by dividing the annual fee each firm volunteers to pay by the number of workers of that firm. For a respondent i in a firm j, we employ a linear regression of the following form:

$$Y_{ij} = \alpha + \beta_i X_i + \delta_j Z_j + \varepsilon_{ij}, \tag{1}$$

where Y_{ij} is the annual licensing fee per worker respondent i in firm j is willing to pay; X_i represents the individual characteristics of respondent i and includes respondent's age, gender, education level, position in the firm as owner, use of subcontractors, and whether the respondent agrees that a mandatory licensing fee will enhance professionalism in the industry; Z_j is a vector of firm-level characteristics including the share of residential tree care services in the firm's activities, whether the firm operates in the Atlanta area, tree trimming and tree removal services, and whether the firm discards wood chips (obtained to reduce wood waste bulkiness) at a landfill. Model (1) is estimated using an Ordinary Least Squares (OLS) estimator. The regression is also weighted by the number of counties in which the firm operates to reduce the influence of outliers,

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that is, the influence of large firms that operate in several Georgia counties (given the limited sample size).

To include respondents suggesting a zero fee and keep them in the sample, we specify the outcome variable using the inverse hyperbolic sine transformation function as $\tilde{y} = \text{arcsinh}(y) = \ln(y + \sqrt{y^2 + 1})$ following Bahar and Rapoport (2018), Bellemare and Wichman (2020), Clemens and Tiongson (2017), Jayachandran et al. (2017), McKenzie (2017), and Muehlenbachs, Staubli, and Chu (2021).[1] The resulting estimated coefficients β_i and δ_j are interpreted as in the case of a regular log-transformed outcome variable. When the regressor is binary, the elasticity is approximated as $\eta_{yx} = \frac{\bar{P}}{100} = \exp(\hat{\beta}_{yx}) - 1$, where η_{yx} is the percentage change in $\hat{y}$ due to a discrete change in the dummy variable x; otherwise, the elasticity is $\eta_{yx} = \hat{\beta}_{yx} \cosh(\text{arcsinh}(y)) * \frac{x}{\hat{y}}$, where η_{yx} denotes the percentage change in y for a unit change in x (Bellemare and Wichman, 2020). The delta method is used to approximate these elasticities.

3.1. Data

The objective of the study required gathering of specific data. The data collection involved several stages. The meeting of the members of the Production and Safety Sub-committee (PSS) of the GAA Board of Directors with university researchers narrowed the areas of interest and identified the questions to be posed to the GAA members. The final electronic version of the questionnaire was created in Qualtrics after the GAA representatives' approval. The survey was distributed among the members of the GAA thorough electronic means, during meetings, via phone calls, and in conversations with individual members. A dedicated website with the posted questionnaire was available online from October to December 2019 and operated by the GAA. Three hundred sixty-eight tree care firms received the invitation to participate in the survey and 153 completed the survey. The collected data include responses about the annual licensing fee size, firm characteristics, and respondent attributes.

Table 2 shows the descriptive statistics. The average per worker license fee a firm would volunteer to pay is about $58 per year. On average, residential tree care services occupy about 36% of firm activities in the sample. Almost 40% of the firms have an annual revenue less than $150,000, and the median number of year-round employees is 7 (with a mean of 20), which indicates the small business nature of most of the firms in the sample.

About 66% and 64% of firms often or very often provide tree trimming and tree removal service respectively while only 13% of firms report disposing of wood chips in a landfill. Almost half of the firms are headquartered in the Atlanta metro area. The average age of the respondents is 51. About 70% of them are male while 18% have at least a bachelor's degree. Additionally, 36% of them believe that mandatory licensing is necessary to establish professionalism in tree care services.

4. Results

Table 3 shows the estimation results. The goodness-of-fit measures suggest that the set of explanatory variables significantly contributed to explaining the observed variation. The overall F-statistic is 51.25 and the adjusted R^2 value of 0.47 is quite high given the cross-sectional nature of the data.

There is a strong positive association between the suggested size of a license fee and the respondent agreeing to the licensing scheme to foster professionalism in the tree care service (Table 3). Relative to respondents who do not favor a licensing fee, respondents who believe that establishing mandatory licensing would encourage professionalism in the tree care sector suggested a 172% per worker higher licensing fee per worker. The difference is quite substantial

[1]As robustness checks, we also estimate the relationship using the licensing fee per worker in its original level form, and using the regular log-transformation (taking additional steps to allow for the zero values).

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Table 2. Summary of descriptive statistics in the sample

Variable name	Obs.	Mean	Std. dev.	Min	Max
IHST of per worker license fee	119	3.79	1.66	0	7
Log of per worker license fee	119	3.21	1.49	0	6
Annual license fee ($)	124	423.77	409.43	0	1225
Number of employees	171	19.70	31.96	1	251
Per worker license fee ($)	119	57.91	89.23	0	613
Total revenue					
Less than $100,000 = 1	175	0.29	0.45	0	1
$100,001 – $150,000 = 2	175	0.10	0.30	0	1
$150,001- $200,000 = 3	175	0.05	0.22	0	1
$200,001 – $500,000 = 4	175	0.10	0.30	0	1
$500,001 – $750,000 = 5	175	0.04	0.20	0	1
$750,001 – $1,000,000 = 6	175	0.05	0.22	0	1
$1,000,001 – $1,500,000 = 7	175	0.07	0.25	0	1
$1,501,000 – $2,500,000 = 8	175	0.06	0.23	0	1
$2,501,000 – $5,000,000 = 9	175	0.11	0.31	0	1
$5,000,001 – $10,000,000 = 10	175	0.07	0.25	0	1
$10,000,001 – $20,000,000 = 11	175	0.03	0.18	0	1
More than $20 million = 12	175	0.03	0.18	0	1
Revenue per employee	166	0.57	0.55	0.004	5
Residential tree care (% of business)	187	35.82	34.33	1	100
Mandatory licensing is necessary = 1	187	0.36	0.48	0	1
Tree trimming service					
Almost never or seldom	150	0.29	0.46	0	1
Neither nor	150	0.05	0.21	0	1
Often or very often	150	0.66	0.48	0	1
Tree removal service					
Almost never or seldom	149	0.30	0.46	0	1
Neither nor	149	0.06	0.24	0	1
Often or very often	149	0.64	0.48	0	1
Dispose wood chip at landfill					
Almost never or seldom	85	0.81	0.39	0	1
Neither nor	85	0.06	0.24	0	1
Often or very often	85	0.13	0.34	0	1
Respondent age	151	51.38	12.20	25	75
Respondent is owner = 1	187	0.46	0.50	0	1

(*Continued*)

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Table 2. (*Continued*)

Variable name	Obs.	Mean	Std. dev.	Min	Max
Male respondent = 1	187	0.70	0.46	0	1
More than bachelor = 1	187	0.18	0.38	0	1
Atlanta area = 1	187	0.49	0.50	0	1
Subcontract work = 1	187	0.43	0.50	0	1
Number of counties of operation	183	7.23	16.66	1	156

Note: IHST denotes inverse hyperbolic sine transformation. *Revenue per employee* is calculated by dividing *Total revenue* by number of employees, where total revenue is ordinal and takes the values from 1 to 12 (1 = less than 100k; 12 = 20M and more).

and shows that there is a sizable group of tree care specialists that strongly support a licensing scheme in the sector.

4.1. Elasticities associated with firm characteristics

As the revenues of a tree care firm increase, the per employee licensing fee increases as well (Table 3). Large firms are able to provide service to a number of customers in a single day, but their size also requires a steady inflow of orders for tree care. Larger firms are also likely undergoing greater scrutiny than small firms in terms of assuring worker safety. Such firms may see a licensing scheme as a way to differentiate themselves from small firms because the proposed scheme is not mandatory. There is evidence from other disciplines that larger firms provided higher quality services (Chen and Hsu, 2009). Another possible explanation is that larger firms have a greater budget flexibility which allows them to pay those fees more readily than smaller firms.

Findings also reveal that firms that often or very often engage in tree trimming propose to pay higher license fees relative to firms who do not provide these types of services. The elasticity varies with the frequency of providing tree trimming service, but is consistently positive (see also Figure 1). Tree trimming is the most commonly provided service by tree care companies. A frequent provision of tree removal services negatively influences the per worker licensing fee (Table 3) although the elasticity is relatively small. Removal of trees is performed less often

than tree trimming implying fewer customers and may involve workers with special skills and costly equipment, while representing a higher risk than just pruning branches. Those factors may temper the readiness of respondents to establish a licensing fee scheme.

Tree care firms that seldom dispose of wood chips at landfills suggested a higher annual license fees relative to firms that do so neither often, nor seldom (Table 3). The calculated elasticity is small but the negative sign is consistent with that of firms disposing of wood chips to landfills often (see Figure 1). Wood chips are produced by converting bulky wood waste from tree services into an easily shipped product. Disposing of wood chips in landfills forces a tree care company to pay the landing fee and such companies may not be amenable to add to their costs.

4.2. Elasticities associated with individual's attributes

The statistically significant explanatory variables include those describing the survey respondent. The older a respondent, the lower is the suggested per worker licensing fee. The proposed fee decreased by 2.2% for every added year to the average age of about 51 years (see also Figure 1). The decrease exceeds 20% for a 60-year-old tree care specialist. The result is not surprising because older respondents have operated without any licensing scheme for decades and may differ in their

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Table 3. Estimation results of the voluntary expressed per worker license fee by respondents from the tree care sector

	Log of per worker license fee	
Variable name	Estimated coefficient	Elasticity
Mandatory licensing is necessary = 1	1.000***	171.823***
	(0.266)	(72.315)
Residential tree care	0.00493	0.176
	(0.00627)	(0.225)
Tree trimming service		
Neither nor	2.466***	0.115***
	(0.766)	(0.036)
Often or very often	2.174**	1.435**
	(0.848)	(0.560)
Tree removal service		
Neither nor	−1.141	−0.069
	(0.946)	(0.057)
Often or very often	−1.415*	−0.902*
	(0.823)	(0.525)
Dispose wood chip at landfill		
Neither nor	−2.869**	−0.169**
	(1.380)	(0.081)
Often or very often	−0.686	−0.089
	(0.818)	(0.105)
Revenue per employee	1.623**	0.921**
	(0.716)	(0.406)
Respondent age	−0.0426**	−2.189**
	(0.0163)	(0.837)
Respondent is owner = 1	−0.522	−40.649
	(0.396)	(23.526)
Male respondent = 1	1.405***	307.611***
	(0.372)	(151.738)
More than bachelor = 1	0.702*	101.860*
	(0.399)	(80.446)
Atlanta area = 1	0.653**	92.154**
	(0.293)	(56.233)
Subcontract work = 1	−0.497	−39.185
	(0.327)	(19.900)
Constant	2.515***	
	(0.917)	

(*Continued*)

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Table 3. (*Continued*)

Variable name	Log of per worker license fee	
	Estimated coefficient	Elasticity
Observations	68	
R-squared	0.590	
Adjusted R-squared	0.472	
F-statistic	51.25	

Notes: The dependent variable is the inverse hyperbolic sine transformation of per worker annual licensing fee. Regressions are weighted by the number of counties where firms operate.
*, **, *** denotes significance at 10, 5%, and 1% level.

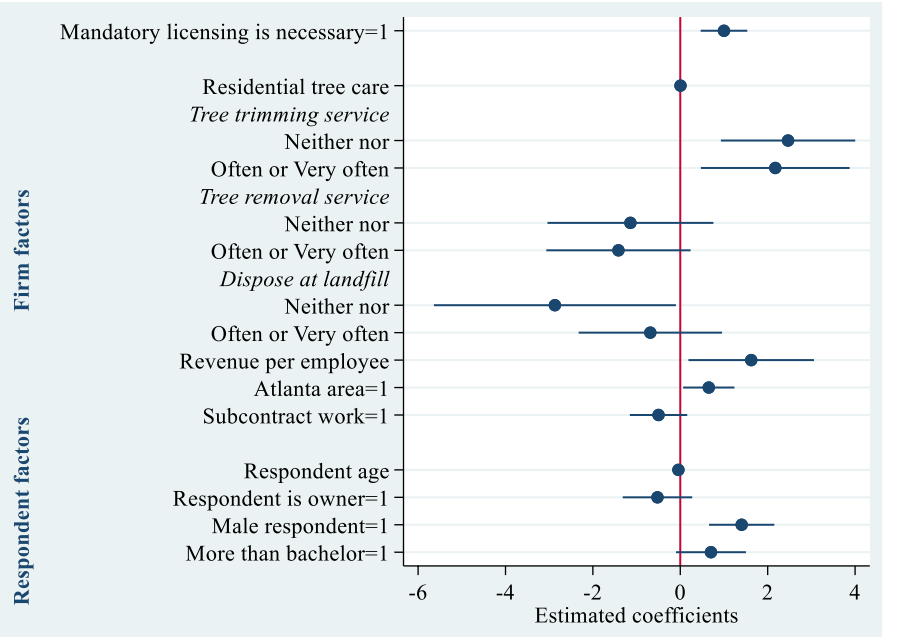

Figure 1. Factors explaining tree care firms' preparedness to pay for a licensing fee.

views from younger tree care firm operators. Older respondents may also enjoy better reputations than younger tree care providers and benefit from word-of-mouth recommendations in a typical, spatially limited area of tree care firm operations.

In contrast to female respondents, a male respondent favored a fee increase by as much as 308%. About 70% of respondents were male and the share of females in the sample exceeded that reported by CDC in the tree care sector by about 1% (2009). In Georgia, where demand for tree care services increases as population and housing expand, there may be more females employed in the sector not only to perform administrative duties, but also in the provision of actual services. If limiting entry to the sector was among the motives behind the proposed licensing scheme, fewer firms offering tree care could translate into higher wages, especially for males who perform the tree pruning, topping, and removal. Expectations of gains could influence male respondents to suggest higher licensing fees than females (see also Figure 1).

Having a university education increased the average suggested per worker fee by as much as 102% in comparison to those with less education. The result was expected because respondents

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with more education were likely more aware of the loss of sector reputation resulting from under par services (see Figure 1). The result coincides with an earlier study by Mardikaningsih and Arifin (2021) who also established a link between higher educational attainment level and the interest in licensing small business. It is quite likely that the effect of education is not specific to a sector or a country. Rather, the link between education and licensing reflects the expectations of the latter to address multifaceted characteristics of professional service delivery. In studies of occupational licensing, requiring a license increased wages (Kleiner and Kreuger, 2010).

4.3. Location

A respondent from a firm located in the Atlanta metropolitan area is likely to suggest a per worker fee 92% higher than a non-metro Atlanta tree care firm. The Atlanta metro area has rapidly expanded in the last couple of decades and 57% of Georgia's total population lives there. Poor performance of any firm non-discriminately affects the reputation of all and firms adhering to high professional standards may experience disproportionally large revenue losses. The average household income in the Atlanta metro area is relatively high allowing for the purchase of tree care services and putting pressure on the delivery of quality services.

The current study's findings are fairly robust to weighting the regression or the use of alternative definitions of the dependent variable such as the log-transformation as well as its form in levels as shown in Tables A1 and A2 in the appendix. Overall, the effects of explanatory variables on the suggested per worker annual licensing fee were significant, and the directional effects generally consistent with expectations reported in empirical studies of attitudes toward regulatory schemes. The fact that respondents who are concerned about the lack of professionalism in the tree care sector propose a higher license fee is expected because higher license fees can serve as incentive for firms to provide quality services. However, licensing fees may also prevent small businesses from entering the industry. The negative effect of age and the positive effect of educational attainment level were reported in other studies of occupational licensing. The successful implementation of a licensing scheme will depend primarily on the ability to convince those less educated, older, and located outside the Atlanta metro area of the benefits of licensing. A future study based on an expanded dataset that includes additional information about the firm could provide additional insights about the inclination to pay a fee and its size in the context of the cost of operating a licensing scheme in the tree care sector.

5. Conclusions

The absence of tree care firm licensing in Georgia has generated a discussion within the sector about ways to enhance professionalism and quality of offered services leading to GAA undertaking efforts to probe its members for opinion. The survey implemented by GAA collected data used in this study. The study is the first to characterize those who would volunteer to pay an annual license fee in the tree care sector. Using a unique dataset collected from the members of the GAA, the study provides a benchmark for further development of the sector's strategy. The current study finds that younger respondents and male respondents show a readiness to pay higher license fees relative to older and female respondents. Additionally, firms with larger revenues, firms operating in the Atlanta metropolitan area, and firms that regularly offer tree trimming services are likely to propose higher license fees. On the other hand, firms that often offer tree removal services, and firms that often dispose of wood chips in landfills are likely to propose lower license fees. Finally, the study confirms that the respondents who agree that mandatory licensing would establish professionalism in the tree care industry are ready to pay higher license fees than those who are satisfied with the sector's professional performance. Results permit the calculation of elasticities measuring the change (an increase or decrease) in the suggested per employee annual licensing fee in relation to firm and arborist characteristics creating a profile of supporters of voluntary licensing.

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Tree care firms' interest in licensing is useful to firms operating in neighboring states since some urban areas in Georgia are located near or at their border and firms are likely to cross state borders driven by revenue opportunities. Additionally, the southern states have been identified as those with large gains in the quality-of-life benefits from urban trees reflecting the tree numbers and steady increase in the region's population and detached housing. However, there is a number of other states with large numbers of urban trees that also lack licensing in the tree care sector, while urban areas across the world are likely need to assure that urban tree care services are of high standards and are able to provide ecoservices to society at large.

The study is not without limitations. The study does not claim causal inferences. Future studies on the topic can rely on a larger sample size covering more states and different climate zones, involving, perhaps, a panel of firms and covering several periods to capture the possible dynamics of the expressed need for a licensing scheme. A more comprehensive survey instrument would provide data needed to establish the causal relationship between specific factors and licensing and the associated firm entry and exit in the context of the quality of offered services. Additionally, a homeowner perspective on the actual experience with tree care providers can provide customer perspectives on the licensing scheme, while learning about the valuation of the benefits supplied by urban trees.

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Appendix

Table A1. Robustness check: factors explaining firm's preparedness to pay for license fees (unweighted estimates)

Variable name	Log of per worker license fee
Mandatory licensing is necessary = 1	0.846***
	(0.295)
Residential tree care	0.00316
	(0.00630)
Tree trimming service	
Neither nor	2.523***
	(0.653)
Often or very often	2.232***
	(0.760)
Tree removal service	
Neither nor	−1.900**
	(0.878)
Often or very often	−1.467*
	(0.874)
Dispose wood chip at landfill	
Neither nor	−2.634**
	(1.124)
Often or very often	−0.310
	(0.768)
Revenue per employee	1.125
	(0.680)
Respondent age	−0.0354**
	(0.0165)
Respondent is owner = 1	−0.164
	(0.448)
Male respondent = 1	0.829*
	(0.431)

(*Continued*)

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Table A1. (*Continued*)

Variable name	Log of per worker license fee
More than bachelor = 1	0.668*
	(0.390)
Atlanta area = 1	0.485
	(0.320)
Subcontract work = 1	−0.350
	(0.367)
Constant	2.872***
	(1.024)
Weighting by number of counties	No
Observations	69
R-squared	0.454
Adjusted R-squared	0.299
F-statistic	245.7

Notes: The dependent variable is the inverse hyperbolic sine transformation of per worker annual licensing fee. Regressions are unweighted. *Revenue per employee* is calculated by dividing *Total revenue* by number of employees, where total revenue is ordinal and takes the values from 1 to 12 (1 = less than $100,000; 12 = $20million and more).

*, **, ***denotes significance at 10, 5%, and 1% level.

Table A2. Factors explaining firm's preparedness to pay for license fees using alternative outcome variables

	Per worker license fee		Log of per worker license fee	
	Unweighted	Weighted	Unweighted	Weighted
Variable name	(1)	(2)	(3)	(4)
Mandatory licensing is necessary = 1	17.85	25.15**	0.756***	0.908***
	(11.53)	(12.27)	(0.267)	(0.241)
Residential tree care	0.106	−0.0143	0.00296	0.00399
	(0.177)	(0.179)	(0.00556)	(0.00546)
Tree trimming service				
Neither nor	39.94	50.18	2.143***	2.060***
	(39.65)	(52.47)	(0.627)	(0.742)
Often or very often	−39.79	−41.28	1.815**	1.726**
	(37.90)	(27.66)	(0.698)	(0.750)
Tree removal service				
Neither nor	20.76	98.01	−1.630**	−0.783
	(42.98)	(64.32)	(0.795)	(0.890)
Often or very often	64.46	90.58*	−1.159	−1.003
	(43.19)	(47.62)	(0.795)	(0.767)

(*Continued*)

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Table A2. (*Continued*)

	Per worker license fee		Log of per worker license fee	
	Unweighted	Weighted	Unweighted	Weighted
Variable name	(1)	(2)	(3)	(4)
Dispose wood chip at landfill				
Neither nor	−52.65**	−80.67*	−2.343**	−2.614**
	(23.99)	(41.87)	(0.965)	(1.235)
Often or very often	−25.43	−39.58**	−0.303	−0.639
	(16.62)	(18.17)	(0.665)	(0.707)
Revenue per employee	54.22**	71.95***	1.134*	1.609**
	(23.42)	(22.05)	(0.605)	(0.630)
Respondent age	−0.862	−1.637	−0.0310**	−0.0385**
	(0.663)	(0.990)	(0.0148)	(0.0151)
Respondent is owner = 1	−19.89	−37.12	−0.184	−0.512
	(16.68)	(26.65)	(0.392)	(0.357)
Male respondent = 1	12.54	42.82**	0.741*	1.306***
	(20.25)	(18.70)	(0.404)	(0.342)
More than bachelor = 1	22.73	11.37	0.610*	0.609*
	(17.55)	(17.34)	(0.357)	(0.362)
Atlanta area = 1	25.85**	29.82**	0.447	0.599**
	(12.09)	(14.57)	(0.285)	(0.265)
Subcontract work = 1	−25.67*	−42.26**	−0.318	−0.472
	(13.70)	(20.53)	(0.325)	(0.298)
Constant	25.67	26.66	2.323**	1.970**
	(43.53)	(51.14)	(0.941)	(0.860)
Weighting by no of counties	No	Yes	No	Yes
Number of observations	69	68	69	68
R-squared	0.466	0.536	0.464	0.602
Adjusted R-squared	0.315	0.402	0.312	0.488
F-statistic	3.076	5.225	29.88	27.13

Notes: The dependent variable is the per worker annual licensing fee in levels (columns 1&2) and in log form (columns 3&4). Results in columns 1 & 3 are unweighted while results in columns 2 & 4 are weighted by the number of counties where firms operate. *Revenue per employee* is calculated by dividing *Total revenue* by number of employees, where total revenue is ordinal and takes the values from 1 to 12 (1 = less than $100,000; 12 = $20 million and more).

*, **, ***denotes significance at 10, 5%, and 1% level.

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