Going green, going clean: Lean-green sustainability strategy and firm growth

Theophilus Lartey[1]; Diana Owusu Yirenkyi[2]; Samuel Adomako[3]; Albert Danso[1]; Joseph Amankwah-Amoah[4]; Ashraful Alam[5]

Corresponding author: Theophilus.lartey2@dmu.ac.uk

Abstract

Despite the widespread recognition of the paybacks of "going green" and "going clean", limited research has focused on the impact of lean-green strategy on firm growth. In this study, we contribute to strategy and environmental sustainability literatures by investigating the possibility that the influence on lean-green strategy and firm growth is driven by different levels of industry competition, managerial power and family ties. Using panel data from 732 firms in four major industrialised economies (the US, Germany, France and the UK), we found that lean-green strategy positively relates to firm growth and this relationship is amplified at higher levels of competition, managerial power and family ties. Theoretical and practical implications of the study are also discussed.

Key words: Environment, sustainability, lean-green strategy, growth, competition, managerial power.

[1] Leicester Castle Business School, De Montfort University, UK.
[2] Huddersfield University Business School, Huddersfield University, UK
[3] Bradford University Management School, Bradford University, UK
[4] Kent Business School, University of Kent, UK
[5] Salford Business School, University of Salford, Manchester UK

1. INTRODUCTION

In recent years, the rise in industrial development has increased negative environmental impacts including toxic pollution, greenhouse gas emission and over-use of natural resources (Sroufe, 2018; Pinkse & Kolk, 2009). In both developed and developing nations, a major requirement is that firms design and manage product processes to reduce toxicity of waste and materials, and conserve natural resources (Thanki et al., 2016). This has impelled both Multinational Corporations (MNCs) and Small and Medium-Sized Enterprises (SMEs) to comply with regulations and restrictions relating to their environmental responsibilities. In an attempt to meet these regulatory requirements, most firms have adopted a lean-green strategy (Cherrafi et al., 2018; Dey et al. 2018; Wong et al., 2018). The strategy literature suggests that firms that adopt a lean-green strategy can enhance their efficiency and reduce costs (Sagnak & Kazancoglu, 2016). Thus, the adoption and infusing of the so-called "clean" and "green" ethos and technologies have the potential to deliver unique performance improvement and durable competitive advantage for firms (see Sroufe, 2018). In addition, firms tend to benefit from lean-green adoption through favourable reviews from customers, pressure groups and other relevant stakeholders (Marodin et al., 2018). The notion and benefits of lean strategy are consistent with Porter's value chain model (Porter, 1980; 2008a, b), which indicates that linkages among value activities can be harnessed to obtain competitive advantage. Furthermore, lean strategy has been found to enhance innovation (Cherrafi et al., 2018) and overall firm performance (Tan et al., 1998; Ng et al., 2015; Carvalho et al., 2017). Thus, when firms strengthen linkages across value activities, they tend to achieve value maximisation (Jayaram et al., 2004).

Although many studies have largely confirmed the performance implications of lean-green strategy, there is a fundamental question: does lean-green strategy relate to firm growth and, if so, under what conditions will this happen? This is an important question to ask because investment in lean strategy would increase the financial costs that a firm had to recover if its business eventually fails. Our aim, therefore, is to fill these gaps in the strategy and environmental sustainability literatures by examining how lean-green strategy influences firm growth. In addition, we examine the extent to

which the impact of lean-green strategy on firm growth is conditioned by levels of industry competition, managerial power and family ties.

Our study makes significant theoretical contributions to business strategy and sustainability literature. First, we extend previous research studies that examine LS and performance (Shah & Ward, 2003; Negrão et al., 2017; Dey et al., 2018) by exploring the effects of integrating LS into the manufacturing process and consequent effects on firm growth. Second, we advance research that shows that LS could enhance firm-level outcomes (Karim et al., 2008; Jayaram et al., 2008) by testing the impact of industry competition under different thresholds on the lean-growth relationship. Third, we add to the environmental sustainability policies and strategy literature (Adomako et al., 2019; Amankwah-Amoah et al., 2019; Danso et al., 2019; Quak & De Koster, 2007; Kashmanian et al., 2011) by examining the moderating role of managerial power on the links between lean-green and firm growth. By investing managerial power in the LS-firm growth linkage, we integrate the corporate governance literature with the strategy literature. Finally, we leverage on the broader literature on family ties (e.g. Anderson & Reeb, 2003; Barontini & Caprio, 2006; Villalonga & Amit, 2006) to identify the extent to which family ties condition the lean green-growth relationship.

The rest of the paper proceeds as follows. First, we present a review of literature on lean policy and firm growth. After this, we present the research method. This is then followed by analysis and discussion of our results. We conclude by setting out the theoretical and practical implications.

2. RELATED LITERATURE AND HYPOTHESES

2.1. Lean strategy and firm growth

Lean is identified as a persistent goal towards eliminating wastage from industrial shop floors and service providers (Verrier et al., 2016; Dey et al., 2018; Wong et al., 2018; Marodin et al., 2018). The history can be partially traced to the strategy founded on the Toyota Production System from the Toyota Motor Company post-Second World War challenges in the Japanese economy (Ohno, 1988).

The strategy ensured the Toyota Company remained competitive whilst helping them mitigate the adverse effects of the war (Womack et al., 1990). With a little innovative tinkering, several processes were implemented which provided solutions and produced more value in highly effective ways – utilising less human effort, time and inventories, less energy, and fewer resources (Abreu, Alves & Moreira, 2017). However, current business challenges necessitate systems beyond efficient and responsive production processes, to include eco-efficient systems (see Cherrafi et al., 2018; Orji & Liu, 2018; Baysan et al., 2019) – hence systems that create more value with lower environmental impacts (Dieste et al., 2019). Both concepts, however, focus on lessening wastage in all forms, including those hardest or invisible to deal with (Abreu et al., 2017). These goals must be attained without increasing the production costs, without any hidden short- or long-term external environmental costs, and to enhance long-term sustainability and firm survival (WBCSD, 2000). A key concept that complements strategic lean is the eco-efficiency or lean-green concept. The foundation of this concept is driven by the need to safeguard nature by conserving its resources via means such as decreasing materials/inventory usage/intensity, decreasing energy usage/intensity, decreasing the quantity and production of toxic substances/products, usage of meaningful end-of-life strategies, championing renewables and recycling of local resources, and enhancing product durability (Hendrickson et al., 2006).

Lean implementation enhances a firm's capability for eliminating wastage from business processes (Baysan et al., 2019). Conventionally, the lean literature focuses on the seven deadly dimensions of wastes: defects, overproduction, unnecessary motion, waiting, unnecessary inventory, transport, and inappropriate processing (Pojasek, 2008; Fercoq et al., 2016; Dieste et al., 2019). These is however augmented to incorporate an eight dimension: lost human capital and potential (Verrier et al. 2016). Table 1 reports a summary of the nexus between the deadly wastes (usually denoted as mudas in Japanese) and their potential green impacts (US EPA, 2007; Baysan et al., 2019). As an illustration, overproduction produces surplus products which may either spoil or go obsolete, and subsequently necessitate disposal.

[Table 1 about here]

Creating value with less impact necessitates high innovative efforts, both at the product and production stages, as well as a unique perspective on the product's environmental performance (Dieste et al., 2019; Hang et al., 2019). Given that the worst impacts of a product may manifest at all stages of the full lifecycle, an organisational strategy is keenly necessitated to mitigate unintended detriments within the lifecycle stages, and to concurrently identify opportunities that may otherwise be difficult to spot. Our contention is that, as firms adopt lean-green approaches, they attain a favourable image with customers, pressure groups and other stakeholders, and this should favourably reflect in their performance and consequently growth. Thus, this leads to our first hypothesis:

H1: *The pursuit of a lean-green strategy is positively related to firm growth.*

2.2. The role of competition

The contemporary business environment is inherently multifaceted and highly uncertain. This consequently heightens firm vulnerabilities particularly for small firms by weakening their ability to compete against established or larger firms (Mengistae, 2006; Hughes & Morgan, 2007). To mitigate such vulnerabilities, normative theory necessitates that firms hone their strategic and entrepreneurial competences (Lee et al., 2001, Wiklund & Shepherd, 2005) to enhance the rapid launch of stealthy attacks on their competitors (Chen & Hambrick, 1995). Moreover, by the Darwinian selection process (deliberated under the dynamic "frictions" model of selection), higher competition tends to drive inefficient firms out of the market and/or apportion larger market share to the highly efficient firms (Syverson, 2004a, 2004b; Bloom et al., 2014). Also, under the agency cost framework, higher competition increases the degree of managerial effort given that the likelihood of bankruptcy increases (Schmidt, 1997; Bloom & Van Reenen, 2007). The Resource-Based View in strategy also posits that performance heterogeneity across firms is due to heterogeneity of firm capabilities and resources (Barney, 1991; Peteraf, 1993; Rahmandad, 2012). Thus, the development of key and unique

capabilities necessitates firms to invest organisational resources to develop and fine-tune highly efficient practices (Helfat & Peteraf, 2003; Winter, 2003). Nevertheless, capability development – both operational and dynamic, (Teece et al., 1997; Eisenhardt & Martin, 2000) – is well understood when firm survival and future performance impel differing demands on firm managers. Simply, competition inherently poses the stoutest of challenges to managers. In reality, the yardstick is not an isolation of a firm's performance or growth prospects but instead whether the firm can survive and shine amidst competition. Addressing environmental issues successfully may increase firm competitiveness, and create new opportunities and approaches that create overall business value (Feng et al, 2018; Danso et al., 2019). Lenox et al., (2006, 2007) confirm the importance of examining the nexus between internal firm components and the external competitive dynamics in their explanation of industry dynamics.

In light of the above, how should managers prioritise lean-green practices amongst production, product development, internationalisation, branding, and other capabilities and resources? This query is fundamental to the Resource-Based View, and its response is dependent not only on the direct returns on investment in the capability but also on the trade-offs in using those returns for future growth or survival in a competitive market. We therefore contend that, in a competitive environment, firms must adopt and implement strategic choices that enhance their competitive advantages over others while sustaining firm growth and survival. Under such a scenario, adoption and implementation of modern lean-green practices is a type of strategic orientation intended to capture how a firm intends to compete and its efforts to surpass, out-manoeuvre and out-do competitors. Hence, we state our next hypothesis as:

> *H2: The effect of a lean-green strategy on firm growth will be significantly positive at a higher level of competition.*

2.3. Managerial power

The concept that executives' choices are central to broadening lacunae on firm behaviour is grounded in management and organisational behaviour literature on managerial discretion (Liu & Jiraporn, 2010; Finkelstein & Hambrick, 1996). Specifically, the basic tenet of several extensive debates focuses on whether managers "matter" for corporate decisions and outcomes (Lewellyn & Muller-Kahle, 2012; Tien et al., 2013; Lisic et al., 2016; Abernethy et al., 2014). Power plays a key role in strategic decision making, strategic choice and strategic change (Child, 1972; Haynes & Hillman, 2010). The Chief Executive Officer (CEO) is inherently the most powerful organisational member (Daily & Johnson, 1997). Extant literature (e.g. Haynes & Hillman, 2010; Tien et al., 2013; Han et al., 2016) examines the impact of powerful CEOs on firm financial performance and strategic change. The CEO's power is naturally credited to their legitimate authority, comprehensive firm knowledge, and has a significant bearing on the firm's strategic direction, structure, and internal processes (Roth, 1995; Haynes & Hillman, 2010). Hence, Wheelen and Hunger (2011) identify the CEO as a firm's "bigwig" who sets the tone for the whole firm.

Finkelstein (1992) proposes four variants of managerial power: structural, ownership, prestige and expert power. First, structural power arises from hierarchy or legitimacy (Hambrick, 1981; Astley & Sachdeva, 1984; Finkelstein, 1992) and thus is easily recognisable within a firm (Brass & Burkhardt, 1993; Chikh & Filbien, 2011). This form of power also represents the CEOs duality role where they also chair the board of directors (Chikh & Filbien, 2011) and is found to be the dominant predictor of power among strategic leaders (Hambrick, 1981; Finkelstein, 1992; Ting, 2013). Second, ownership power accumulates as a function of both formal (equity ownership) and informal (as founder or relative of founder) organisational impact (Pfeffer, 1992; Chikh & Filbien, 2011). A CEOs may amass power due to their ownership positions in their firms which in effect enables them to be an embodiment of both management and shareholders (Pfeffer, 1981). Evidence suggests that CEOs with significant shareholdings are relatively highly powerful and as such have a high impact on core strategic firm decisions (Zald, 1969; Ting, 2013). In addition, founders possess significant organisational and strategic influence (Boeker, 1989; Eisenhardt & Schoonhoven, 1990). A founder

CEO or a CEO related to the founder may amass power via increased interactions and long-term relationship with board members and other key stakeholders (Finkelstein, 1992). Hence, Daily and Johnson (1997) contend that CEOs with ownership power are better at implementing their strategic choices. The core foundation of strategy is choice to drive firm performance (Porter, 1991). Thirdly, prestige power may amass from an individual's membership in the managerial elite or association with an elite educational institution which signals to others their importance, both within and outside the firm (Ting, 2013). That is, the social networks, education-based networks and other ties of CEOs (Chikh & Filbien, 2011). CEOs inherently constitute the managerial elite merely by occupying organisational positions of key importance (Giddens, 1972; Nguyen-Dang, 2008).

Lastly, expert power is amassed from the breadth in managerial assignments during a CEO's career (i.e. CEO tenure) which enhances their ability to effectively manage the firm's external environment (Walters et al., 2007) and interpret market signals effectively (Aktas et al., 2011). A CEO who acquires experiences from different functional areas can effectively build contacts both within and outside the firm and across an extensive range of areas relative to CEOs with limited functional experience (Daily & Johnson, 1997), hence enabling them to effectively mitigate environmental uncertainties faced by the firm (Finkelstein, 1992). With expert power, CEOs may possess the ability to exert control over directors and other stakeholders via control of firm-specific information (e.g. extensive knowledge of firm affairs) (Baldenius et al., 2014).

Roscoe et al. (2019) stressed that championing a green organisational culture necessitates strong leadership focus, message credibility, peer involvement, and employee empowerment. With significantly greater information than non-management directors, CEOs have the power to control access to such information. Harris and Raviv (2005, p. 359) term this as the "strategic choice of information advantage" which enables CEOs to implement strategic choices effectively. While we submit that lean-green practices has a direct impact on firm growth, the strategic role of CEOs – particularly when they are powerful – is expected to strengthen this nexus. Executives' preferences

manifest when they hold powerful positions (Haynes & Hillman, 2010). Thus, we contend that a CEO's preferences with respect to strategic change or choices succeed when the CEO is powerful. Hence, we predict that:

> H3: *The effect of a lean-green strategy on firm growth will be significantly positive at a higher level of managerial power.*

2.4. Family ties

The strategic role of ownership structures on firm dynamics has been extensively examined in theoretical and empirical literature (Barth et al., 2005; Chrisman et al., 2005; Gibb Dyer Jr, 2006; Prencipe et al., 2008; Silva & Majluf, 2008; Yang, 2010). In public firms, ownership and control are generally segregated (excluding managerial ownership), which consequently creates conflicts of interest between shareholders and firm managers (Jensen & Meckling, 1976; Fama & Jensen, 1983). Although these agency problems can be mitigated via monitoring, the presence of information asymmetries ensures that shareholders are not well informed (Andres, 2008), thus creating the free-rider problem where shareholders resist any temptation to invest their personal resources in the firm-monitoring activity (Grossman & Hart, 1980; Holmstrom, 1982).

In relation to large vs small shareholders, large shareholders have adequate private resources and are therefore more willing to spend these resources to monitor and discipline management. Hence, the presence of large investors may mitigate any free-rider problems (Shleifer & Vishny, 1986). Additionally, given that voting power is not dispersed among an extremely heterogeneous or segmented group, large investors can easily coordinate their efforts/actions and put pressure on managers. Where managers repeatedly refuse to comply with directives from the large investor, they stand the chance of being displaced soon. Hence, although large blockholders may have other strong incentives besides agency costs reduction, they do possess the power to affect these costs (Shleifer & Vishny, 1997; King & Santor, 2008). Concentrated ownership structures can, however, create adverse

challenges. First, large blockholders largely champion their personal interests rather than those of other stakeholders. Hence, they are very likely to utilise their control rights to maximise their personal wealth to the disadvantage of other shareholders. The likelihood of minority shareholder expropriation is usually greater when large blockholders possess voting rights in excess of cash flow rights (Faccio et al., 2001; Dyck & Zingales, 2004). Under such a scenario, there is a higher chance of unequal distribution of company cash flows among all shareholders (Andres, 2008).

Similar to other large shareholders (e.g. state, financial institutions and other companies), families have a greater incentive to monitor managers, reduce agency costs and increase firm value. The incentive is particularly strong because families inherently utilise more of their private wealth for firm investments and their investments may not be well-diversified (Andres, 2008). Hence, families fall under the unique type of blockholders with unique apprehensions regarding firm survival and greater incentives for close monitoring of management. Where their monitoring role necessitates the knowledge of a firm-specific or market-specific technology, a family may possess advantages given their long-term presence in the firm.

Following these theoretical bases, it is uncertain as to whether large blockholdings (in this case, large family shareholding) favour all shareholders or what the aggregate impact of their influence will be on firm growth. Additionally, empirical studies have yet to provide evidence regarding the impact of ownership concentration structures on firm growth. For other firm dynamics, recent empirical evidence suggests that family ownership is associated with superior firm performance when compared to externally owned firms (Anderson & Reeb, 2003, Villalonga & Amit, 2006, Barontini & Caprio, 2006). Claessens et al. (2002) reported a positive and significant nexus between firm value and the cash flow ownership of the largest shareholder. This they construed as confirmation of the positive incentive effect of large shareholdings. Demsetz and Villalonga (2001) find no evidence of the presence of a nexus between ownership concentration and firm performance. Thomsen et al. (2006) find a negative effect of blockholder ownership on firm performance and construed this as

confirmation of agency conflicts between large blockholders and minority shareholders. McConaughy et al. (2001) and Andres (2008) report that family firms are more profitable and also outperform firms with other types of blockholders. Nevertheless, family firm performance is better only when the founding family is still active either on the executive or the supervisory board (Andres, 2008). Similarly, Villalonga and Amit (2006) show that family ownership enhances firm value only if the founder serves as CEO or as board chair with a professional CEO. Anderson and Reeb (2003) report that firm value decreases when descendants serve as CEOs. Sraer and Thesmar (2007) find that family firms outperform public firms particularly for firms with family CEO as well as for descendant-managed firms. This they construe via the implicit insurance contracts of employees in descendant-managed firms: employment is less sensitive to industry shocks and as a consequence heirs pay lower wages. Barontini and Caprio (2006) confirm the finding that market valuation and operating performance are higher in founder-controlled corporations and at least not worse in descendant-controlled firms. Hence, we predict that:

H4: The effect of a lean-green strategy on firm growth will be significantly positive at a higher level of family ties.

3. RESEARCH METHODOLOGY

3.1. Data and Variables

We exploit the unique database of middle-sized firms included in the World Management Survey (WMS) (see discussion in Bloom & Van Reenen, 2007, and Bloom et al., 2014). The database provides over 12 years' data from over 11,300 manufacturing firms across 34 countries and is among the largest and most globally comparable firm-level management practices database. The management data were drawn via an interview-based methodology which scores firms from 1 (worst practices) to 5 (best practices) on 18 key business practices segregated in three core themes: monitoring, target-setting and incentives/people management. Thus, (1) the efficiency with which a firm tracks manufacturing operations and plants and any actions to support continuous improvement;

(2) the firm's ability to set appropriate targets, track closely aligned outcomes, and take appropriate action where necessary, and (3) whether the firm steadily tries to recruit and retain the best employees, and/or promotes and rewards employees based on their performance. For purposes of obtaining accurate responses, the WMS utilises a 'double-blind' protocol where managers have no actual knowledge about being scored or the scoring grid. In addition, no additional information about financial performance is requested. Instead, financial data were obtained and merged directly from the Amadeus database for European firms (Germany, France and the UK) and the Compustat dataset for US firms. The WMS survey solely includes firms belonging to the manufacturing industry with at least 50 but not more than 10,000 employees. Hence, only medium-sized and large-sized or highly-established firms are included. Given that the US firms in the WMS sample are slightly larger than their counterparts from other countries, we follow Bloom et al. (2014) to carefully control for firm size and public listing status in our analyses. Our final sample comprises all firms with the necessary accounts data between 1994 and 2010.

3.2. Measures

Lean-green is conceptualised as a three-dimensional construct, consisting of (1) firms' knowledge and implementation of modern lean-green manufacturing techniques, (2) the rationale for lean-green implementation, and (3) the success of implemented modern manufacturing techniques (Bloom et al., 2014). Constructs 1 and 3 are with four items each on a five-point Likert scale ranging from 1= worst practice to 5= best practice. In other words, 1 = where no improvements are effected via lean particularly when challenges arise; and 5= where divulging challenges structurally is fundamental to individuals' responsibilities, and improvements are effected as a part of normal business processes rather than by extraordinary effort/teams. The second construct, rationale for lean-green implementation, has two items on a similar Likert scale as the other two constructs. Lean-green, which proxies for the firm's lean-green implementation and strategy, is computed as the mean value across the three constructs for each firm.

Growth (sales): Growth typically proxies for expected future growth, or the growth of an investment project that creates a potential for increases in profits. This paper measures Growth as the natural logarithm of five-year annual growth of sales. We utilised the Tobin's Q (Tobin & Brainard, 1968; Tobin, 1969; Tobin, 1978) as a robust measure of firm growth and value-creation opportunities (Aivazian et al., 2005; Fauver & Naranjo, 2010; Lin & Lee, 2011; Bhabra et al., 2018). We compute the Tobin's Q as the market value of assets divided by the book value of assets as a robustness measure for firm growth prospects. If Tobin's Q does represent firm growth and value creation opportunities, there should be a positive relationship between the Tobin's Q ratio and future operating performance for a firm (Shin & Park, 1999; Walker, 2000).

Competition: To examine the role of competition on the strategic lean-firm growth nexus, we follow the competitive environment literature (e.g. Ino & Kawamori, 2009; Menezes & Quiggin, 2012; Cabral et al., 2018; Plambeck & Taylor, 2018) and measure competition using the number or density of competitors declared by the manager/CEO. We split the sample of firms into quantiles where the

number of competitors that fall in the top one-third quantile (75^{th} P) are marked as firms in highly competitive environments or industry, whilst those in the bottom one-third quantile (25^{th} P) are marked as less competitive environments or industry.

Managerial power: We measure managerial power as a two-dimensional construct consisting of (1) level of seniority of the manager (i.e. structural power), (2) whether or not the manager is the founder (i.e. ownership power). The seniority construct draws on a five-point Likert scale ranging from 1=technician, 3=plant manager, 5=executive/director, while the manager status construct is an indicator variable equal to one if the manager is the founder, and zero otherwise. Managerial power, which proxies for the manager's ability to adopt and implement modern lean-green processes strategically, is computed as the mean value across the two constructs for each firm.

Family ties: Following Bloom et al. (2014), we capture family ties under four (4) key groupings. First, family largest shareholder firms as firms where a single family (combined across all family members, who are all second generation or beyond) represent the largest blockholders. Second, we control for management and control structure where the family is the largest blockholder and management is under the control of a family CEO, hence a subset of family largest shareholder firms where the CEO is also a family member. Third, families usually perceive their firms as assets that should be passed on from generation to generation, rather than consumed during a lifetime (Casson, 1999; Chami, 1999; Andres, 2008). Demsetz and Lehn (1985) used the term "amenity potential" to denote the nonpecuniary private benefits of control by families. Under such conditions, families find pleasure in seeing their offspring or descendant run the affairs of family firms. Thus, we further control for another subset of family largest blockholding of "family largest shareholder and family CEO" firms where the eldest male child is the CEO upon succession (primogeniture firms). However, given that possessing the ability to both manage and control may result in sub-optimal firm investment decisions (Anderson et al., 2012), we finally augment the analysis to control for both family and external ownership (a mixed structure).

Control variables: In line with other empirical studies (Bloom & Van Reenen, 2007; Archibugi et al., 2013 and Bloom et al., 2014), we controlled for other variables that are likely to affect firm growth. These variables are Employees' Productive Capability – the natural logarithm of net revenue per employee (internal resources of firms); Operational Complexity –the natural logarithm of the book value of total inventory; Firm Size – the natural log of total assets; Firm Age – the natural logarithm of the time between a firm going public and the end of the fiscal year; R&D intensity – the natural logarithm of proportion of a firm's R&D expenditure to total sales (potential for future innovations); Listing Status – a proxy for whether a firm is listed or not (i.e. a variable equal to one if a firm is listed, and zero otherwise); Managers (MBA) – the proportion of a firm's managers with an MBA; Employees (degree) – the proportion of a firm's employees with a university degree (human capital); CEO Gender – an indicator variable equal to one if the CEO is male, and zero otherwise.; and CEO Tenure – the natural logarithm of number of years the CEO has served in the position as of the end of the fiscal year. Following Bloom et al. (2014), we include a set of interview noise controls to mitigate biases across interviewers and types of interviewees. These include the number of countries the manager has worked in, the day of the week the interview was conducted, the time of the day the interview was conducted, the duration of the interview, whether a firm prepares consolidated accounts or not, and an indicator of the reliability of the information provided by the respondent. All regressions incorporate three-digit industry dummies and four country dummies interacted with a full set of time dummies (Mengistae, 2006).

3.3. Estimation method

In this section, we model the empirical relationship between lean-green strategy and firm growth. Specifically, we employed the following econometric framework:

$$Firm\ Growth_{i,t} = \alpha + \beta Leangreen_{i,t} + \beta X_{i,t} + \omega_i + \mu_t + \varepsilon_{i,t}$$

Where *i* denotes the *i*th firm and *t* denotes fiscal year. Lean-green is the firm-level lean-green strategy score, Firm Growth is the five-year annual growth of sales by year *t*, X is the vector of the control variables employed in our analysis, α and β are parameters, ω_i is the vectors of country and industry dummies, and μ_t is the vector of noise controls. We use the pooled OLS and controlled for time fixed effects by including time dummies in all estimations. In order to control for possible heteroscedasticity and autocorrelation within firms, the estimated standard errors of the regression coefficients are clustered at the firm level.

[Table 2 about here]

4. RESULTS

In Table 2, we present the descriptive statistics of the variables for our empirical analysis. The mean value of our independent variable (Lean-green) for all the four countries examined is 3.297. In general, this variable exhibits a low degree of variability represented by a standard deviation of 1.025 across all the countries examined. We also report our measure of the dependent variable (firm growth). The mean value of this variable for all the countries examined is 11.797 with a standard deviation of 1.444. In general, the descriptive statistics of the variables are fairly homogeneous across the four countries examined.

[Table 3 about here]

We also present in Table 3 the correlation between the variables used in our study. A preliminary insight into the relationship between Lean-green and our two measures of firm growth (Growth–sales and Tobin's Q) is also illustrated by the correlation matrix. We observe that the correlation (but not necessarily causal relationship) between our measure of lean-green strategy and firm growth is positive. This provides preliminary support that lean-green strategy is positively related to firm growth. In relation to the control variables, the correlation among them shows that there is no issue

of multicollinearity. Generally, the findings from both tables 2 and 3 show that none of the variables suffer from any serious bias that is likely to plague the regression results.

[Figure 1 about here]

Figure 1 shows the distribution of raw lean score per firm across all three constructs and across countries. We observe from this a significantly greater spread in modern lean practices across firms. We note that a greater number of firms seem to be particularly bad at implementing modern lean strategies. In addition, we observe substantial heterogeneity in modern lean practices across our sample of countries. US firms are relatively better at implementing modern lean practices than European firms. A firm scoring two or less basically has very limited strategies implemented to sustain firm performance and growth. This particularly greater heterogeneity supports our core research question: what are the key motivations behind implementing lean-green strategies? Can it be the need for the firm to survive and grow?

[Figure 2 about here]

To explore the extent to which low managerial power, low competition and primogeniture family succession can explain firms' inability to implement lean-green strategically, we segregated our sample based on these measures. Panel 1 of Figure 2 plots the strategic lean-green histogram for all firms associated with low competition and primogeniture succession (A) versus high competition and no-primogeniture succession (B). We observe that the weak implementation of modern lean-green strategies is significantly greater in the low competition and primogeniture sample, with 16.4% of firms scoring two or less, relative to 9.0% for high competition and no-primogeniture firms. Panel 1 plots the strategic lean-green histogram for low managerial power and/or primogeniture family succession firms (A) versus the strategic lean-green histogram for high managerial power and no-primogeniture succession firms (B). The comparison indicates that the weak implementation of modern lean-green strategies is significantly greater in the low managerial power and primogeniture sample, with 13.6% of firms scoring two or less, relative to 2.2% for high managerial power and no-

primogeniture firms. Panel 3 plots the strategic lean-green histogram for low managerial power, low competition and primogeniture succession firms (A) versus high managerial power, high competition and no-primogeniture succession firms (B). Consistent with the above findings, the joint impact indicates that the weak implementation of modern lean-green strategies is significantly greater in the low managerial power, low competition and primogeniture sample, with 13.6% of firms scoring two or less, compared to 10.8% for high managerial power, high competition and no-primogeniture firms. Overall, given that 13.6% of all sampled firms score two or less, controlling for managerial power, competition and primogeniture succession seems to mitigate over half of the strategic challenges of modern lean-green implementation.

[Table 4 about here]

Hypothesis 1 stated that the relationship between lean-green strategy and firm growth will be positive In Table 4, we present our baseline results of the impact of lean-green strategy on firm growth. Models 1 and 2 report the results after incorporating country and time dummies. In addition to the country and time dummies, Model 3 accounts for industry effects using three-digit SIC while Model 4 incorporates the set of interview noise controls. Starting with models 1-2, the result proves that lean-green strategy has a positive and statistically significant impact on firm growth at 1% level. This significant impact is maintained after controlling for industry and noise effects in models 3 and 4. We used the Tobin's Q to solidify our results and present the estimation results in models 5 to 8. We find that, regardless of whether we include control variables, the estimated impact of lean-green strategy on firm growth measured by Tobin's Q remains unaffected. Hence, we find support for our main research proposition, as the effect of lean-green implementation on firm growth is positive and statistically significant (i.e. Hypothesis 1).

[Table 5 about here]

Our analysis so far confirms that lean-green drives firm growth. However, a probable issue is that a firms' performance or CEO power may affect firm growth and perhaps the firm's ability to implement

or adopt modern lean practices. For instance, a successful organization can have high growth potential and simultaneously have greater financial slack to implement or adopt modern lean practice accordingly. Specifically, lean-green strategy may not be the cause of firm growth, but firms' or CEOs' goal to achieve greater performance or amass power can necessitate greater investment in lean-green. Given this scenario, the results may be biased due to endogeneity through omitted variables ("unobserved heterogeneity"). To overcome such bias, we rely on an instrumental variable approach using the two-stage Generalized method of moments (GMM) estimation and show that our findings remain robust. To choose the instrument, we posit that powerful CEOs have greater ability to implement lean-green strategies. We regress the lean-green component on the firm level variables (Employee productivity, operational complexity, firm size, firm age, listing status, managers (MBA), employees (degree), CEO gender, and CEO tenure), and include the predicted variables in the second stage. The results are presented in Table 5. Our results remain essentially unaffected suggesting that the instrument is valid and relevant (Baum, 2006). Overall, the results corroborate our earlier finding that the implementation or adoption of modern lean practices should enhance firm growth. Our earlier findings are not plagued by endogeneity problems and are robust with respect to the alternative econometric model.

Hypothesis 2 proposed that the effect of lean-green strategy on firm growth will be significantly positive at a higher level of competition. To test this, we split the sample of firms into quantiles where the number of competitors that fall in the top one-third quantile (75^{th} P) are marked as firms in highly competitive environments or industry, whilst those in the bottom one-third quantile (25^{th} P) are marked as less competitive environments or industry. The results are presented in models 7 to 12 of Table 6 below. Indeed, the results confirm and complement our main findings that lean-green strategy and firm growth are positively related. Nonetheless, regardless of whether we include control variables, the results show that the impact of lean-green strategy on firm growth is significant at 10% level for firms operating in less competitive environments. In contrast, the impact is significant at 1% for firms operating in highly competitive environments. Accordingly, Hypothesis 2 is supported.

[Table 6 about here]

Hypothesis 3 argued that the effect of lean-green strategy on firm growth will be significantly positive at a higher level of managerial power. In Table 6, we split the sample of managers into quantiles

where the managers in the top one-third quantile (75^{th} P) of the managerial power score are marked as very powerful managers, whilst those in the bottom one-third quantile (25^{th} P) are marked as less powerful managers. The results are presented in models 1 to 6 of Table 6 below. First, the results are consistent with and complementary to the main findings that lean-green strategy and firm growth are positively related. Nevertheless, it is worth noting that the impact of lean-green strategy on our growth measure is insignificant for less powerful managers irrespective of whether we introduce noise controls or not. For very powerful managers, the coefficients for lean-green strategy on firm growth are statistically significant at 5% level without noise controls and 1% level after introducing noise controls. This result provides support for our Hypothesis 3.

[Table 7 about here]

Hypothesis 4 stated that the effect of lean-green strategy on firm growth will be significantly positive at a higher level of family ties. In Table 7, we report the result under the four key family tie classifications. With and without controls (general, noise controls, and country and time effects), the results are consistent with and complementary to the main findings. Under Panel A (models 1 to 3), we observe a statistically significant impact (at 5% level) of lean-green strategy on "family largest shareholder" firms' growth. Again, under Panel B (models 4 to 6) we observe that the coefficients for lean-green strategy on "family largest shareholder and family CEO" firms' growth are statistically significant at 5% level without noise controls and 1% level after introducing noise controls. However, it is worth noting that the results under Panel C (models 7 to 9) show a statistically insignificant impact of lean-green strategy on "Family largest shareholder, family CEO, and primogeniture" firms' growth with or without controls. To mitigate concerns associated with primogeniture firms, we introduced the mixed structure under Panel C (models 10 to 12) to proxy the enhanced monitoring role of external owners. We observe a statistically significant impact (at 5% level) of lean-green strategy on firm growth of firms that have a mix of family and external ownership. The above results lend support to our fourth hypothesis.

4.1. Robustness assessment

We established the robustness of our research model by performing additional analyses. First, we used the z-score of the lean-green strategy constructed by z-scoring the individual questions, averaging these and then z-scoring this average, thus yielding a lean-green strategy score normalised to mean zero and standard deviation one. Replicating our baseline estimations using this index or score yields a very similar result. Similarly, our result is not different after using the first principal component from a factor analysis. Overall, the results obtained from using alternative measures of lean-green strategy on the two measures of firm growth suggest that the strategic implementation of lean-green strategy increases firm growth; the effect is both statistically and economically significant. In a further robustness analysis, we used the Lerner index as proxy for competition and computed as the mean of (1 − profit/sales) for every country-industry pair (Bloom et al., 2014; Aghion et al. 2005). Replicating our baseline estimations using the Lerner index yields a very similar result.

4.2 Explaining country-level variations in lean-green strategy

The literature on family firm performance reports mixed findings when analysed under different economic and regulatory jurisdictions. While some international evidence contends that family firms have superior performance relative to non-family firms in the US (McConaughy et al., 1998; Anderson & Reeb, 2003) and France (Sraer & Thesmar, 2007), others found opposing evidence for Canada (Klein et al., 2005), the UK (Short & Keasey, 1999; Poutziouris et al., 2015) and Australia (Welch, 2003). On an international level, Lins (2003) contends that family blockholding or control significantly drives firm value particularly where firms are domiciled in countries with low shareholder protection. Hence, in Table 8, we attempt to account for the variations in lean practices across countries. Under Model 1, we regress the lean-green score on dummy variables for Germany, France and the UK (with the US serving as the baseline/benchmark). The US is used as a baseline

because US firm managers are found to adopt efficient management practices (Bloom & Van Reenen, 2007; Genakos, 2018). These efficiently managed firms are swiftly compensated with greater market share whilst those managed inefficiently tend to dwindle swiftly and exit (Bloom et al., 2014). We find that German, UK and French firms are significantly worse at adopting or implementing modern lean-green practices than US firms on average, with a gap of 0.560, 0.419 and 0.338 respectively. In Model 2, we incorporate firm-specific controls for firm age, listing status and R&D stock to address cross-country variations that may arise due to the presence of more mature and unlisted firms in the European jurisdictions relative to the US. We found German and UK firms are significantly worse at adopting or implementing modern lean-green practices than US firms on average, with a gap of 0.238 and 0.117 respectively. French firms are worse relative to US firms, but not significantly so, with a smaller gap of 0.059.

[Table 8 about here]

In Model 3, we augment our baseline specification in Model 1 and incorporate control for managerial power, whose coefficient is positive and significant at 5% level. The results confirm and complement our main findings in Model 2. However, the coefficients on all country variables increased significantly, indicating the extensive presence of powerful CEOs within large firms particularly in Germany. In Model 4, we again introduced our firm-level control variables to address cross-country firm variations. Consistent with earlier results, German and UK firms are significantly worse at adopting or implementing modern lean-green practices than US firms on average, with a gap of 0.213 and 0.109 respectively. French firms are worse relative to US firms, but not significantly so, with a smaller gap of 0.049.

In Model 5, we augment our baseline specification in Model 3 to account for competition faced by a firm. Consistent with the earlier results, competition enters the specification with a positive and significant coefficient (at 1% level). The lean-green coefficient on the UK dummy dropped slightly (by 0.034), indicating a marginally lower level of competition in the UK relative to the US (Bloom

& Van Reenen, 2007). By contrast, the coefficients for France and Germany dropped greatly, by 0.131 and 0.042 respectively, since the degree of competition is lesser for French or German firms compared to US firms (Bloom et al., 2014). In Model 6, we again introduced our firm-level control variables to address cross-country firm variations. The results are consistent with earlier results in Model 4: German and UK firms are significantly worse at adopting or implementing modern lean-green practices than US firms on average.

In Model 7, we augment our baseline specification in Model 3 to account for family ties via a dummy for primogeniture family firms, whose coefficient is negative and significant at the 1% level, as expected. The coefficients on the French and U.K. dummies dropped significantly, by 0.245 and 0.098 respectively, indicating the widespread existence of family firms with traditional primogeniture progression rules particularly in France. In Model 8, we again introduced our firm-level control variables to address cross-country firm variations. Although the results are consistent with earlier results, the coefficients for France and the UK dropped greatly, by 0.078 and 0.033 respectively. Overall, managerial power and competition accounts for 39% (=100 × (0.338− 0.206)/ 0.338) of the gap between the US and France, 7.3% (=100 × (0.560− 0.519)/ 0.560) of the gap between the US and Germany, and 10% (=100 × (0.419 − 0.377)/ 0.419) of the gap between the US and UK.

In Model 9, we augment our baseline specification in Model 3 to account for all three conditions (managerial power, competition and family firm status). Although the coefficients on all country variables increased slightly, the results are consistent with our earlier prediction regardless of whether we include general firm-level control variables. German and UK firms are significantly worse at adopting or implementing modern lean-green practices than US firms on average, with a gap of 0.521 and 0.335 respectively. French firms are worse relative to US firms, but not significantly so, with a smaller gap of 0.124. Overall, the joint effect of the three conditions (managerial power, competition and family firm status) accounts for 72.8% (=100 × (0.338− 0.092)/ 0.338) of the gap between the US and France, 23.4% (=100 × (0.419 − 0.321)/ 0.419) of the gap between the US and UK, and 7.3%

(=100 × (0.560− 0.516)/ 0.560) of the gap between the US and Germany. Overall, the result indicates that managerial power, competition and family firm status play key roles in explaining cross-country adoption of modern lean-green practices.

5. DISCUSSION AND IMPLICATIONS

The paper examined the extent to which the relationship between lean-green strategy and firm growth is conditioned by level of industry competition, managerial power and family ties. The findings of the current study suggest that the implementation of modern lean-green practices is more beneficial when firms are domiciled in highly competitive environments. Firms must adopt and implement strategic choices that enhance their competitive advantages over others while sustaining firm growth and survival. Overall, such firms with greater number of competitors should have a higher incentive to act promptly to adopt lean-green practices rather than wait.

An additional mechanism that significantly drives managers' motivation and ability to implement strategic decisions is underpinned by the level of power or authority the manager possesses. Thus, very powerful managers should have fewer challenges when it comes to adopting modern strategic practices such as lean, which suggests that managerial power plays a dominant role in the implementation of firms' strategic decisions (Combs et al., 2007; Haynes & Hillman, 2010; Lisic et al., 2016). Executives' preferences manifest when they hold powerful positions (Finkelstein, 1992; Haynes & Hillman, 2010). Thus, a CEO's preferences with respect to strategic change or choices succeed when the CEO is powerful.

Theoretically, the findings extend the strategy and sustainability literatures in several ways. First, we examine how the relationship between lean strategy and firm growth is shaped by family ties. Our findings indicate that, because family firms generally utilise more of their private wealth for firm investments, they are better suited to support strategic goals that will enhance the likelihood of

recouping their investments. Moreover, because the high family stake prevents external investors from bidding for or holding shares in the firm (which may lead to poor market valuation – Barclay & Holderness, 1989), family firms tend to adopt modern practices that indirectly signal positive outcomes to outsiders in order to draw positive valuations and reputations – hence the adoption of modern lean practices that enhance operational efficiency and reduce wastage and environmental effects.

Examining the subset of family largest shareholder firms where the CEO is also a family member, we noted that knowledge and experience can easily be passed on, and agency conflicts may also be mitigated particularly where the family CEO is on the executive board. Also, the long-term investment and profit maximisation horizon of family blockholding also necessitate family CEOs to foster reputations that drive their relationship with clients and external stakeholders (James, 1999). A key means of championing the goal of creating a working environment that fosters trust and loyalty is to adopt and implement modern lean practices that enhance operational efficiency and reduce wastage and environmental effects. Thus, they are unlikely to forego long-term interests to primarily enhance current earnings.

For primogeniture firms, we noted that, because entrepreneurial spirit and expertise are only partly inherited (Morck et al., 1998), lean-green strategy has no strategic impact on firm growth. Descendants at the helms of affairs steadily regress towards choices which affect firm performance and growth immaterially. The role of families in manager and executive board member selection also increases entrenchment. This consequently induces descendants and founders to remain at the helm of affairs even though they may no longer be competent. Shleifer and Vishny (1997) identify this challenge as one of the largest costs that greater family blockholding can impose. Family control by heirs promotes slower growth due to inefficiencies arising from entrenchment, greater restrictions against outside control and low investment in innovation (Morck et al., 1998). Where heirs serve as CEOs, firm value is destroyed because conflict in primogeniture firms is more costly than under other

family firm controls (Villalonga & Amit, 2006). This is particularly true if family interests do not match with the interests of other shareholders (Jensen & Meckling, 1976; Fama & Jensen, 1983). Moreover, instead of maximising firm value, entrenched families may be incentivised to switch firm profits for private rents, hence expropriating minority shareholders (Faccio et al., 2001). Families can also incur costs that do not directly come at the expense of profits (Andres, 2008). Hence, the presence of a mixed structure should help mitigate these concerns via enhanced management monitoring and pressure. We observe that lean-green strategy significantly drives firm growth under a mix of family and external ownership.

Furthermore, where a firm's operations are domiciled also explains the firm's choice to adopt lean-green strategies. The joint effect of the three conditions (competition, managerial power and family ties) accounts for 72.8% of the US-France gap, 23.4% of the US-UK gap and 7.3% of the US-Germany gap for modern lean-green adoption or implementation, hence indicating that competition, managerial power and family firm status play key roles in explaining cross-country adoption of modern lean-green practices. On aggregate, German and UK firms are significantly worse at adopting or implementing modern lean-green practices than US firms, with a gap of 0.521 and 0.335 respectively. French firms are worse relative to US firms, but not significantly so, with a smaller gap of 0.124. We observe an extensive presence of powerful CEOs within large firms particularly in Germany. A widespread existence of family firms is observed particularly in France. Nevertheless, both French and German firms record a marginally lower level of competition. Thus, although German firm managers possess high power, the weak competitive environment constrains the adoption of strategic lean-green practices. The stronger presence of family firms in France family relative to their competitive environment tends to induce a higher adoption of modern lean-green practices which should indirectly signal positive outcomes to outsiders in order to draw positive valuations and reputations.

Beyond the theoretical perspectives discussed above, our findings offer valuable insights for firms. Our findings suggest that the adoption of lean-green strategy plays an important role in influencing firm growth. Firms that develop and adopt lean-green strategies are likely to attain better growth. Thus, it is important for firms seeking growth to incorporate into their strategies the adoption of lean-green strategies. These findings are particularly important for firms that operate in a highly competitive environment.

5.1. Conclusion and direction for future research

This study documents significant cross-country evidence of a positive relationship between lean-green strategy and firm growth. Further tests reveal that the influence on lean-green strategy and firm growth is conditioned by different levels of industry competition, managerial power and family ties. Notwithstanding the contributions made, it is important to acknowledge some limitations. First, we only looked at four developed countries and the findings obtained may therefore be specific to this setting and not even hold in developing countries where firms face multiple regulatory and institutional challenges. In this respect, a broad-based study targeting both developing and developed countries is warranted. Also, comparison of studies along industrial lines can be carried out to understand the lean-green growth relationship on an industrial basis.

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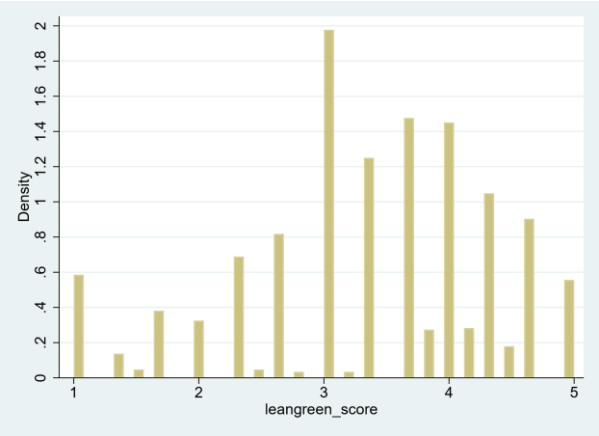
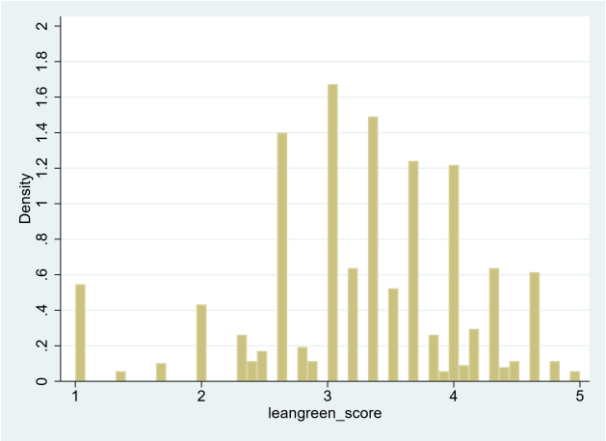
Figure 1: Cross-country disposition of Lean-green scores

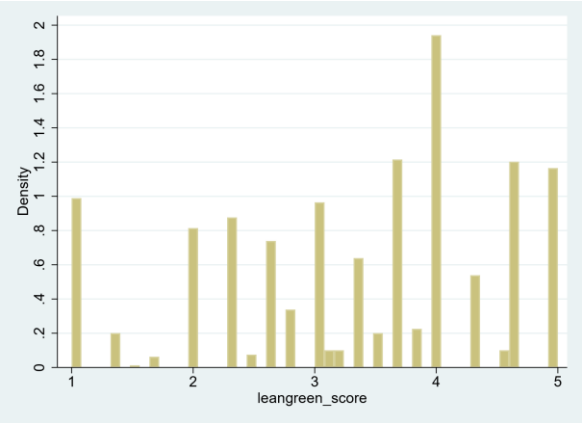
USA



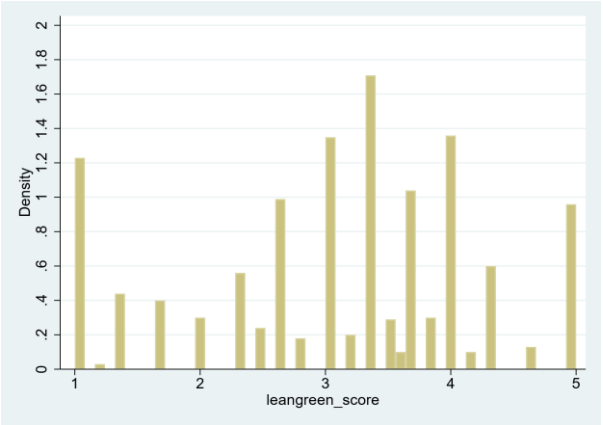
Germany



France



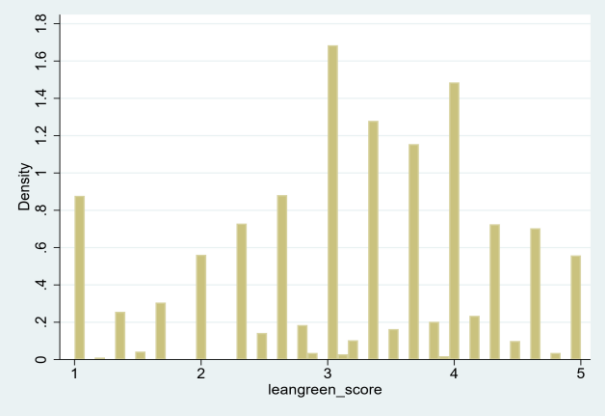
UK



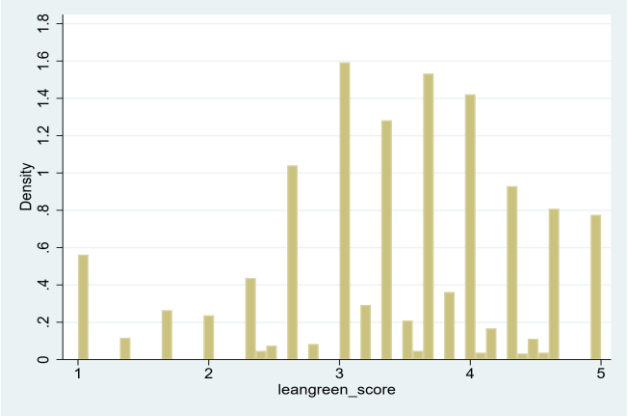
The figures report the distributions of the raw lean-green scores (the mean value across the 3 constructs for each firm). 1 = worst practice, 5 = best practice. Overall, there is a significantly greater spread in modern lean-green practices across firms and countries.

Figure 2: Distribution of Lean-green Scores Split by Competition, Managerial Power and Family Firms

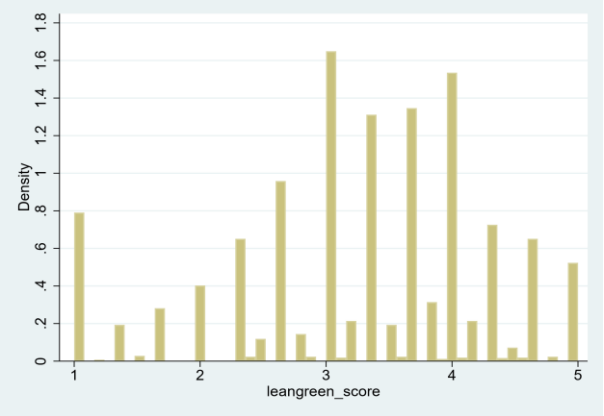
Panel 1A - Low Competition & Primogeniture



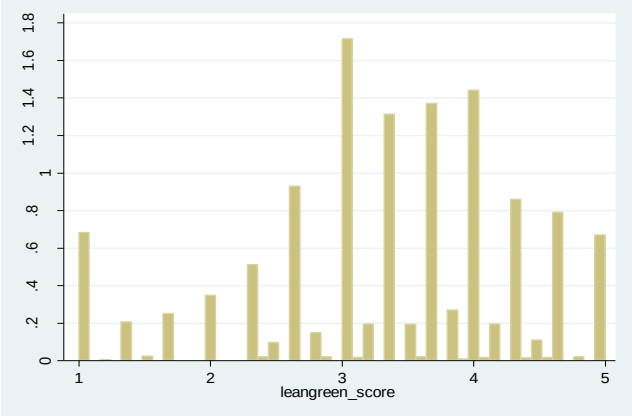
Panel 1B - High Competition & Non-primogeniture



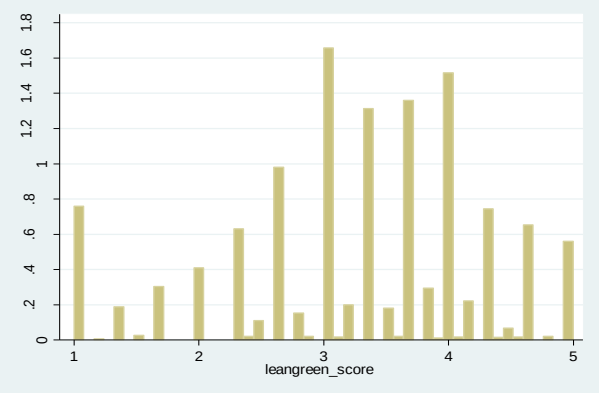
Panel 2A - Low Managerial Power & Primogeniture



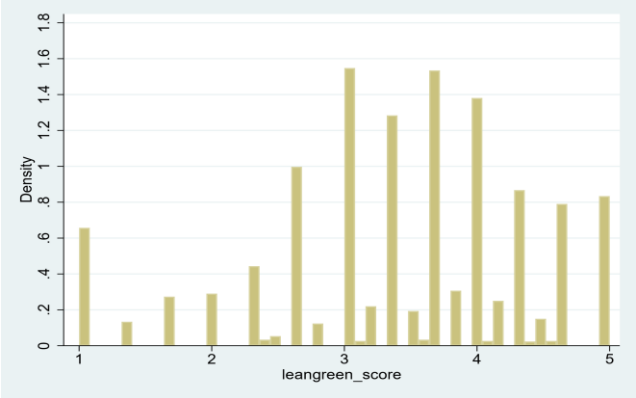
Panel 2A - High Managerial Power & Non-primogeniture



Panel 3A - Low Managerial Power, Low Competition & Primogeniture



Panel 3B - High Managerial Power, High Competition & Non-primogeniture



1 = worst practice, 5 = best practice. Panel 1 reports average lean-green scores for firms with either low, or high competition and family being the majority shareholder with CEO appointed via primogeniture. Overall, 16.4% of low-competition and primogeniture firms score two or less, relative to 9.0% for high-competition and non-primogeniture firms. Panel 2 reports average lean-green scores for firms with either low, or high managerial power and family being the majority shareholder with CEO appointed via primogeniture. Overall, 13.6% of low managerial power and primogeniture firms score two or less relative to 2.2% for high-managerial power and non-primogeniture firms. Panel 3 reports average lean-green scores for firms with either low, or high managerial power, Competition, and family being the majority shareholder with CEO appointed via primogeniture. Overall, 13.6% of low-managerial power, low-competition and primogeniture succession firms score two or less, compared to 10.8% for high-managerial power, high-competition and non-primogeniture firms.

Table 1: Modern lean mudas and their potential green impacts

Modern Lean Muda	Potential green impacts
Overproduction	*Excess product defects *Superfluous usage of energy and raw materials. * Increased safety issues due to hazardous substances *Potential increase of direct output emissions
Unnecessary inventory	*Shelves of unused office supplies *Perishable products may go bad before usage or before being sold *Excessive power usage for heating/cooling/lighting *Potential extra material used *Increase rubbish production due to added packaging *Increase potential of products deterioration
Transport	*Sending unsold products from the store back to the warehouse * Potential increase of gaseous emissions from vehicles *Long order time of parts or products from distant suppliers *Increased energy usage in transports *Generated emissions in the air *Special risks in case of hazardous freight (spills etc)
Unnecessary motion	*Software usage requires too much time *Employees searching for materials, tools or equipment *Printers and other equipment that are not conveniently located *Inadequately stocked inventory *Increased usage of space and energy. *High investment in equipment and materials to support unnecessary motions
Defects	*Software with bugs that has to be re-coded *Development of parts and products that don't meet safety regulations *Incorrect data entry *Products that are shipped to the wrong address *Manufactured items fail to meet the customer's specifications *Waste of raw materials and energy * Special risks in case of hazardous freight (spills etc)
Inappropriate processing	*Software features never required to support processes *Complex purchasing processes with multiple approval levels *Superfluous energy and raw materials usage *Increased rubbish and emissions created *Potentially hazardous processes
Waiting	*Operatives or engineers waiting for code to be developed *Clients waiting for products to be delivered *Operating machines take too long to respond (System downtime) *Suppliers don't get paid earlier which delays production * Manufacturing processes waiting for component delivery *Wasted energy and resources, and increased likelihood of material damages
Lost human capital and potential	*Time is spent correcting errors or responding to emergencies *Employees lack opportunities to learn new skills or utilise hidden talents *Employees are not involved in process improvement *Employees lack opportunities for advancement within the company *Employees spend time on tasks that do not add value *People with advanced skills do routine work

Table 2: Descriptive statistics

		All	USA	Germany	France	UK
PANEL A						
Lean-green	Mean	3.297	3.371	3.281	3.347	3.098
	S.D.	1.025	0.994	0.850	1.147	1.106
Growth (sales)	Mean	11.797	12.088	12.225	11.156	11.254
	S.D.	1.444	1.470	1.111	1.241	1.455
Tobin's Q	Mean	0.479	0.485	0.475	0.104	0.626
	S.D.	1.036	1.113	0.653	0.831	0.861
Employee Productivity	Mean	6.699	6.948	7.038	5.985	6.391
	S.D.	1.335	1.392	1.120	1.090	1.269
Operational Complexity	Mean	10.951	11.433	11.192	10.184	10.384
	S.D.	1.676	1.556	1.286	1.545	1.772
Firm Size	Mean	10.113	10.473	10.571	9.012	9.731
	S.D.	1.685	1.732	1.263	1.495	1.563
Firm Age	Mean	55.322	50.166	92.131	40.236	47.087
	S.D.	50.393	40.405	75.509	27.712	42.417
Listing status	Mean	0.632	1.000	0.431	0.157	0.329
	S.D.	0.482	0.000	0.495	0.364	0.470
Managers (MBA)	Mean	1.577	2.766	0.102	0.233	1.348
	S.D.	3.921	5.219	0.290	0.677	2.662
Employees (Degree)	Mean	22.164	30.462	14.369	15.102	14.469
	S.D.	19.094	21.808	13.452	9.587	12.287
CEO Gender	Mean	0.020	0.024	0.006	0.008	0.030
	S.D.	0.139	0.154	0.080	0.089	0.169
CEO Tenure	Mean	4.918	5.029	5.161	4.785	4.553
	S.D.	4.337	3.845	5.091	4.859	4.239
Number of Firms		732	290	156	135	151
PANEL B						
Managerial power	Mean	1.612	1.711	1.302	1.470	1.765
	S.D.	0.533	0.557	0.414	0.397	0.526
Competition	Mean	2.474	2.551	2.343	2.313	2.538
	S.D.	0.525	0.520	0.493	0.482	0.549
Family majority shareholders	Mean	0.214	0.103	0.303	0.309	0.323
	S.D.	0.410	0.305	0.460	0.462	0.468
Family majority shareholders & family CEO	Mean	0.134	0.075	0.102	0.195	0.255
	S.D.	0.341	0.263	0.302	0.396	0.436
Family majority shareholders & family CEO & Primogeniture	Mean	0.075	0.029	0.030	0.151	0.166
	S.D.	0.263	0.167	0.169	0.358	0.372
Observations		6,267	2,920	1,098	998	1,251

The table presents the summary statistics for all variables used in our core growth assessment.

Table 3: Correlations matrix

	Lean-green	Growth (Sales)	Tobin's Q	Employee Productivity	Operational Comp	Firm Size	Firm Age	Listing	R&D intensity	% Managers (MBA)	% Employees (degree)	CEO Gender	CEO Tenure
Lean-green	1.00												
Growth (Sales)	0.08*	1.00											
Tobin's Q	0.11*	0.20*	1.00										
Employee Productivity	0.05*	0.64*	-0.25*	1.00									
Operational Comp	0.04*	0.64*	-0.20*	0.64*	1.00								
Firm Size	0.04*	0.60*	-0.26*	0.58*	0.53*	1.00							
Firm Age	-0.04*	0.28*	-0.17*	0.30*	0.24*	0.27*	1.00						
Listing status	0.07*	0.30*	0.01	0.33*	0.36*	0.32*	0.08*	1.00					
R&D intensity	0.12*	0.22*	0.28*	0.18*	0.30*	0.21*	-0.06*	0.49*	1.00				
Managers (MBA)	0.14*	0.01	0.04	-0.02	0.04*	-0.00	-0.08*	0.18*	0.14*	1.00			
Employees (Degree)	0.09*	0.01	0.12*	-0.04*	0.02	-0.03	-0.10*	0.12*	0.17*	0.34*	1.00		
CEO Gender	0.02	-0.00	0.04	0.00	0.00	0.00	-0.08*	0.04*	-0.00	0.03	-0.01	1.00	
CEO Tenure	-0.03	-0.04*	-0.08*	-0.03	-0.04*	-0.05*	0.08*	0.01	-0.02	-0.03	0.10*	-0.00	1.00

The table presents the unconditional correlation coefficient between any pair of variables. * Indicates significance at 1%.

Table 4: Lean-green on firm growth

	Growth (Sales)				Growth (Tobin's Q)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Lean-green	0.057***	0.019***	0.015**	0.016**	0.139***	0.131***	0.068**	0.085**
	(0.028)	(0.007)	(0.007)	(0.008)	(0.048)	(0.048)	(0.046)	(0.048)
Employee Productivity		0.524***	0.534***	0.521***		0.366**	0.231	0.390**
		(0.036)	(0.033)	(0.033)		(0.150)	(0.193)	(0.195)
Operational Comp		0.298***	0.306***	0.307***		-0.143	0.003	0.227**
		(0.037)	(0.026)	(0.025)		(0.107)	(0.129)	(0.113)
Firm Size		0.190***	0.152***	0.152***		-0.160	-0.285	-0.640***
		(0.029)	(0.026)	(0.025)		(0.174)	(0.185)	(0.170)
Firm Age			-0.019**	-0.022**			-0.033	-0.005
			(0.010)	(0.010)			(0.067)	(0.064)
Listing status			0.062*	0.073**			0.188	0.019
			(0.035)	(0.034)			(0.263)	(0.307)
R&D intensity			0.005	0.002			0.244***	0.215***
			(0.008)	(0.008)			(0.050)	(0.048)
Managers (MBA)			0.003	0.002			-0.005	-0.001
			(0.002)	(0.002)			(0.009)	(0.010)
Employees (Degree)			0.016	0.020			0.180***	0.233***
			(0.012)	(0.012)			(0.068)	(0.070)
CEO Gender			0.013	0.013			0.256	0.324*
			(0.057)	(0.056)			(0.164)	(0.195)
CEO Tenure			0.001	0.001			-0.014	-0.017
			(0.002)	(0.002)			(0.012)	(0.010)
Constant	5.847***	2.990***	2.922***	2.924***	0.332	1.260*	0.872	-0.436
	(0.345)	(0.247)	(0.155)	(0.176)	(0.488)	(0.656)	(1.503)	(1.831)
Country Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Effects	No	No	Yes	Yes	No	No	Yes	Yes
Noise controls	No	No	No	Yes	No	No	No	Yes
N	5350	5350	5350	5350	2635	2635	2635	2635
r2	0.714	0.974	0.980	0.981	0.131	0.148	0.422	0.471
N_clust	709	709	709	709	374	374	374	374

All models use time dummies and spells country, time and industry effects. Standard errors robust to heteroscedasticity and clustering at firm level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 5: Lean-green on firm growth: 2-Step GMM

	Growth (Sales)				Growth (Tobin's Q)			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Lean-green	0.165***	0.037***	0.024**	0.025**	0.268***	0.246***	0.177***	0.163***
	(0.064)	(0.010)	(0.010)	(0.011)	(0.061)	(0.061)	(0.055)	(0.058)
Employee Productivity		0.506***	0.489***	0.490***		0.326**	0.355**	0.331**
		(0.035)	(0.035)	(0.035)		(0.161)	(0.150)	(0.149)
Operational Comp		0.307***	0.314***	0.311***		-0.133	-0.118	-0.075
		(0.037)	(0.038)	(0.037)		(0.117)	(0.113)	(0.108)
Firm Size		0.204***	0.208***	0.205***		-0.194	-0.269*	-0.292*
		(0.032)	(0.032)	(0.031)		(0.146)	(0.148)	(0.150)
Firm Age			-0.013	-0.013			0.003	0.028
			(0.009)	(0.010)			(0.052)	(0.051)
Listing status			0.051	0.050			-0.059	-0.028
			(0.038)	(0.038)			(0.282)	(0.301)
R&D intensity			0.006	0.009			0.225***	0.218***
			(0.007)	(0.008)			(0.040)	(0.037)
Managers (MBA)			0.002	0.001			-0.019	-0.022
			(0.002)	(0.002)			(0.014)	(0.016)
Employees (Degree)			0.037***	0.035***			0.218***	0.274***
			(0.012)	(0.013)			(0.062)	(0.061)
CEO Gender			0.013	0.013			-0.037	-0.046
			(0.065)	(0.066)			(0.136)	(0.153)
CEO Tenure			-0.000	-0.000			-0.016	-0.014
			(0.002)	(0.002)			(0.010)	(0.010)
Constant	10.110***	2.734***	2.707***	2.811***	0.044	1.082***	0.933*	0.261
	(0.225)	(0.102)	(0.115)	(0.139)	(0.225)	(0.392)	(0.506)	(0.624)
Country Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Industry Effects	No	No	Yes	Yes	No	No	Yes	Yes
Noise controls	No	No	No	Yes	No	No	No	Yes
N	4777	4777	4777	4777	2421	2421	2421	2421
N_clust	702	702	702	702	372	372	372	372
K-P WF statistic	502.143	463.556	464.348	360.453	247.566	251.434	264.894	183.459
K-P LM statistic	200.319	200.503	191.280	183.227	106.748	103.112	104.102	104.684
Hansen J statistic	13.138	2.420	2.266	2.802	5.017	7.592	3.045	1.517
Hansen J p-value	0.018	0.120	0.132	0.094	0.025	0.106	0.181	0.218

All models use time dummies and spells country, time and industry effects. Standard errors robust to heteroscedasticity and clustering at firm level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 6: Lean-green on firm growth (sales) - Do managerial power and competition matter?

	Competition						Managerial Power					
	Low Competition (25th P)			High Competition (75th P)			Low Managerial Power			High Managerial Power		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Lean-green	0.090*	0.088*	0.113*	0.170***	0.141***	0.129***	0.029	0.045	0.028	0.135**	0.099**	0.134***
	(0.050)	(0.045)	(0.044)	(0.048)	(0.043)	(0.044)	(0.084)	(0.075)	(0.075)	(0.055)	(0.048)	(0.048)
Firm Age		0.324***	0.266***		0.156***	0.143**		0.390***	0.272***		0.201***	0.176***
		(0.058)	(0.056)		(0.057)	(0.056)		(0.097)	(0.091)		(0.063)	(0.060)
Listing status		0.790***	0.717***		0.541***	0.574***		0.666**	0.654**		0.833***	0.810***
		(0.182)	(0.183)		(0.164)	(0.165)		(0.272)	(0.274)		(0.193)	(0.191)
R&D intensity		0.567***	0.467***		0.597***	0.501***		0.536***	0.396***		0.600***	0.506***
		(0.040)	(0.042)		(0.039)	(0.044)		(0.053)	(0.054)		(0.045)	(0.049)
Managers (MBA)		-0.002	0.022*		0.003	0.022**		-0.014	0.007		-0.006	0.009
		(0.018)	(0.012)		(0.013)	(0.010)		(0.021)	(0.017)		(0.016)	(0.012)
Employees (Degree)		-0.106	-0.146**		-0.136**	-0.171***		-0.036	-0.077		-0.080	-0.128*
		(0.069)	(0.069)		(0.063)	(0.065)		(0.113)	(0.117)		(0.073)	(0.075)
CEO Gender		0.098	0.263		0.371	0.480*		-0.395	0.133		0.395	0.455
		(0.346)	(0.335)		(0.259)	(0.270)		(0.634)	(0.620)		(0.278)	(0.307)
CEO Tenure		-0.021**	-0.024***		-0.019**	-0.021**		-0.024*	-0.028**		-0.016	-0.021**
		(0.009)	(0.009)		(0.009)	(0.009)		(0.013)	(0.013)		(0.010)	(0.010)
Constant	11.703***	8.330***	8.060***	11.915***	9.220***	8.646***	11.656***	7.809***	7.006***	12.041***	8.648***	8.728***
	(0.182)	(0.398)	(0.628)	(0.180)	(0.378)	(0.584)	(0.301)	(0.646)	(1.004)	(0.206)	(0.416)	(0.683)
Country Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Noise Controls	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
N	6267	6267	6267	5825	5825	5825	2253	2253	2253	5370	5370	5370
r2	0.112	0.335	0.431	0.362	0.530	0.565	0.101	0.383	0.492	0.311	0.491	0.555
N_clust	732	732	732	679	679	679	250	250	250	636	636	636

All models use time dummies and spells country, time and industry effects. Standard errors robust to heteroscedasticity and clustering at firm level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 7: Lean-green on firm growth (sales) - Do family ties matter?

	Family majority shareholder			Family majority shareholder, and family CEO			Family majority shareholder, family CEO, & primogeniture			Family and external ownership		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
Lean-green	0.179**	0.150**	0.173**	0.188**	0.241**	0.263***	0.141	0.199	0.002	0.138**	0.095**	0.137**
	(0.096)	(0.090)	(0.076)	(0.099)	(0.104)	(0.093)	(0.129)	(0.119)	(0.078)	(0.067)	(0.058)	(0.054)
Firm Age		-0.212	-0.185		-0.451***	-0.519***		-0.336	-0.175		0.251***	0.225***
		(0.140)	(0.142)		(0.169)	(0.161)		(0.203)	(0.109)		(0.072)	(0.067)
Listing status		0.121	-0.143		-0.055	-0.223		0.455	0.056		0.978***	0.940***
		(0.306)	(0.312)		(0.374)	(0.362)		(0.630)	(0.417)		(0.195)	(0.182)
R&D intensity		0.566***	0.355**		0.573***	0.269		0.665***	-0.029		0.587***	0.493***
		(0.109)	(0.139)		(0.186)	(0.219)		(0.110)	(0.139)		(0.047)	(0.052)
Managers (MBA)		-0.125	-0.075		-0.198	-0.054		0.143	0.178		-0.011	0.004
		(0.120)	(0.105)		(0.124)	(0.115)		(0.289)	(0.196)		(0.018)	(0.013)
Employees (Degree)		0.130	0.034		-0.032	-0.119		0.283	0.691***		-0.003	-0.051
		(0.133)	(0.151)		(0.186)	(0.176)		(0.209)	(0.171)		(0.080)	(0.085)
CEO Gender		-0.373*	0.241		-0.395	0.403		-0.373***	0.241*		0.191	0.253
		(0.212)	(0.310)		(0.249)	(0.335)		(0.119)	(0.153)		(0.402)	(0.412)
CEO Tenure		-0.022*	-0.029**		-0.010	-0.007		-0.008	-0.001		-0.021**	-0.028***
		(0.011)	(0.012)		(0.014)	(0.014)		(0.012)	(0.010)		(0.011)	(0.010)
Constant	11.109***	10.053***	10.194***	10.745***	11.100***	10.691***	10.209***	10.275***	15.013***	12.238***	8.189***	7.810***
	(0.326)	(1.020)	(1.340)	(0.294)	(1.218)	(1.740)	(0.409)	(1.557)	(1.409)	(0.248)	(0.491)	(0.817)
Country Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Time Effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Noise Controls	No	No	Yes	No	No	Yes	No	No	Yes	No	No	Yes
N	1320	1320	1320	828	828	828	463	463	463	4328	4328	4328
r2	0.303	0.472	0.585	0.283	0.488	0.686	0.272	0.609	0.870	0.326	0.524	0.599
N_clust	161	161	161	97	97	97	52	52	52	497	497	497

All models use time dummies and spells country, time and industry effects. Standard errors robust to heteroscedasticity and clustering at firm level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$

Table 8: Lean-green on firm growth (sales) - Explaining country-level variations in lean-green strategy

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
USA	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline	Baseline
Germany	-0.560***	-0.238***	-0.553***	-0.213**	-0.519***	-0.216***	-0.516***	-0.248***	-0.521***	-0.249***
	(0.076)	(0.083)	(0.076)	(0.083)	(0.076)	(0.083)	(0.073)	(0.080)	(0.072)	(0.079)
France	-0.338**	-0.059	-0.337	-0.049	-0.206	-0.084	-0.092	-0.006	-0.124	-0.022
	(0.148)	(0.147)	(0.149)	(0.148)	(0.160)	(0.152)	(0.160)	(0.152)	(0.163)	(0.155)
UK	-0.419***	-0.117**	-0.419***	-0.109**	-0.377***	-0.121**	-0.321***	-0.088**	-0.335***	-0.098**
	(0.035)	(0.050)	(0.035)	(0.050)	(0.042)	(0.051)	(0.040)	(0.049)	(0.041)	(0.050)
Managerial power			0.019	0.051**	0.031	0.046*	0.020	0.037	0.016	0.032
			(0.024)	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)	(0.024)
Competition					0.144***	0.157***			0.134***	0.147***
					(0.025)	(0.026)			(0.025)	(0.025)
Family majority shareholder, & family CEO							-0.528***	-0.474***	-0.510***	-0.453***
							(0.053)	(0.054)	(0.054)	(0.055)
Listing status		0.021		0.020	0.018	0.002	-0.006	-0.021	-0.022	-0.036
		(0.036)		(0.036)	(0.036)	(0.036)	(0.035)	(0.035)	(0.036)	(0.036)
Firm Age		-0.037**		-0.035**		-0.038**		-0.008		-0.012
		(0.015)		(0.015)		(0.015)		(0.015)		(0.015)
R&D intensity		-0.021		-0.020		-0.020		-0.017		-0.018
		(0.015)		(0.015)		(0.015)		(0.015)		(0.015)
Managers (MBA)		0.027***		0.027***		0.028***		0.027***		0.028***
		(0.003)		(0.003)		(0.003)		(0.003)		(0.003)
Employees (Degree)		0.118***		0.117***		0.116***		0.102***		0.103***
		(0.020)		(0.020)		(0.019)		(0.019)		(0.019)
CEO Tenure		0.002		0.001		0.001		0.003		0.003
		(0.003)		(0.003)		(0.003)		(0.003)		(0.003)
Constant	-0.221	-1.189***	-0.242	-1.264***	0.860***	0.404*	-0.680***	-1.159***	1.105***	0.564**
	(0.189)	(0.221)	(0.191)	(0.223)	(0.205)	(0.220)	(0.204)	(0.222)	(0.205)	(0.220)
Noise	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	6267	6267	6267	6267	6267	6267	6267	6267	6267	6267
r2	0.156	0.184	0.156	0.185	0.166	0.191	0.180	0.199	0.184	0.204

Standard errors robust to heteroscedasticity and clustering at firm level in parentheses. * $p < 0.10$, ** $p < 0.05$, *** $p < 0.01$