Abstract
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Owners and Ecological Corporate Entrepreneurship:
The Effect of Family Ownership on Eco-innovation

ABSTRACT

This study examines the effect of family ownership on firm-level engagement in eco-innovation. Building on institutional theory and socioemotional wealth theory, we develop a model outlining the mediating role of concern for company reputation gains and the moderating role of the owning-family’s transgenerational intentions and of its local embeddedness. Our model is tested with data from the German part of the Community Innovation Survey using nonlinear moderated mediation analysis. We find support for most of our hypotheses and discuss key academic and practical implications.

Keywords:
Family ownership, eco-innovations, nonlinear moderated mediation analysis
INTRODUCTION

The present-day ownership landscape comprises a wide variety of owner identities, each with their own unique goals and preferences (Thomsen & Pedersen, 2000); examples include founding-families, banks, corporations, mutual funds, pension funds, and hedge funds. The identity of the owners behind a firm has significant implications for its strategic decision-making process, with blockholders frequently influencing top management such that firm strategies fit their agenda (Connelly et al., 2010). It is not surprising that one of the most widespread owner identities, namely family blockholders (La Porta, Lopez-de-Silanes & Shleifer, 1999; IFERA, 2003), has received significant academic interest. As scholars continue to unravel the impact of family ownership on firm strategies, the innovation process has become a popular field of interest (for a review, see De Massis, Frattini & Lichtenthaler, 2013). Innovation represents a key manifestation of corporate entrepreneurship (Sharma & Chrisman, 1999), and prior empirical studies revealed how family ownership shapes aspects such as R&D spending, open innovation collaborations, and the efficiency of the innovation process (e.g., Chrisman & Patel, 2012; Classen et al., 2012; Duran et al., 2016). Yet, beyond generic distinctions – such as explorative versus exploitative activities (Goel & Jones, 2016) or product versus process innovations (Classen et al., 2014) – little is known about how family ownership affects particular types of innovation with particular underlying motivational drivers. We investigate how and when family ownership influences a firm’s engagement in one particular type of innovation, namely environmentally friendly or so-called eco-innovations.

In examining eco-innovations, our study is situated at the intersection of corporate entrepreneurship and corporate sustainability. Corporate sustainability deals with the interconnection between firms and the natural environment, and highlights how a narrow focus
on short-term profit maximization by firms may ultimately undermine the broader system in which they operate (Bansal & Song, 2017). Sustainable behavior implies that firms consider the long-term effects of their actions – including their entrepreneurial actions – on the natural system which surrounds them (Slawinski & Bansal, 2015). Eco-innovations fit this categorization since they represent new or significantly improved products, processes or organizational methods that create environmental benefits compared to alternatives (OECD, 2005; Carrillo-Hermosilla, del Rio & Könnölä, 2010). In comparison to other aspects of the innovation process previously investigated by family business scholars, for eco-innovations very particular owner considerations are at play such as the role of institutional pressures and the search for legitimacy (Greenwood & Hinings, 1996; Berrone et al., 2013). Gaining a deeper understanding of the association between family ownership and eco-innovations is also relevant from a societal perspective. Policy-makers have shown increasing concern for the impact of economic activity on the natural system (e.g., United Nations\(^1\), European Commission\(^2\)) and insight in the conditional effect of the most prevalent form of business ownership on firms’ eco-innovation levels may prove helpful in optimizing innovation- and sustainability-related policies.

In this study, we develop and test a moderated mediation model linking family ownership to eco-innovations. Building on institutional theory (Scott, 1987) and socioemotional wealth theory (Gomez-Mejia et al., 2011), we propose that family-owned firms show greater engagement in eco-innovation than their non-family counterparts, in part because they are more concerned about the firm’s ecological reputation (cf. Berrone et al., 2010). We also acknowledge the heterogeneity of family-owned firms, and argue that the positive or so-called “extended”


\(^{2}\) [https://ec.europa.eu/environment/ecoap/frontpage_en](https://ec.europa.eu/environment/ecoap/frontpage_en)
socioemotional wealth perspective (Miller & Le Breton-Miller, 2014) is most likely to manifest itself when the owning-family is locally embedded and has transgenerational intentions. That is, we propose that family blockholders are particularly inclusive and farsighted in their strategic considerations—a tension between business and society as well as a tension between the short term and the long term (for a discussion, see Slawinski & Bansal, 2015). Although these tensions are interrelated, inclusive decision-making refers mainly to the first tension, and farsighted decision-making mainly to the second tension.

This model is tested using data from the 2015 German version of the Community Innovation Survey, which contains unique information on family influence and eco-innovations among a representative sample of German firms.

This study makes several contributions. First, we advance the literature on family firms’ corporate entrepreneurial efforts, more particularly their innovation-related behaviors. Most prior research on this subject highlighted drawbacks of family control, including lower R&D spending (e.g., Gomez-Mejia et al., 2014), less variety in innovation partnerships (e.g., Classen et al., 2012), and fewer patent citations (e.g., Block et al., 2013). Our findings reveal that, by promoting engagement in eco-innovation, family control also has positive implications for the innovation process. This study thereby contributes to a more nuanced understanding of family firm innovation, and supports recent findings on family firm benefits in particular domains like employees’ innovative involvement (Bammens, Notelaers & Van Gils, 2015) and innovation efficiency (Duran et al., 2016). A strength of our study is that we model and measure a key mediating mechanism, namely concern for reputation, explaining why family firms engage more in eco-innovation. Second, this study offers insight on the heterogeneity of family firms. While

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Strategic decisions on ecological corporate entrepreneurial efforts such as eco-innovations are characterized by a tension between business and society as well as a tension between the short term and the long term (for a discussion, see Slawinski & Bansal, 2015). Although these tensions are interrelated, inclusive decision-making refers mainly to the first tension, and farsighted decision-making mainly to the second tension.
some indicated that families are particularly farsighted and inclusive in their decision-making (e.g., Dyer & Whetten, 2006; Miller, Le Breton-Miller & Scholnick, 2008), others portrayed them as being centered on parochial family interests (e.g., Le Breton-Miller, Miller & Lester, 2011; Rees & Rodionova, 2015). We help unravel some of these differences by testing the role of the owning-family’s transgenerational intentions and of its local embeddedness as key contingency factors. Third, we advance the broader research stream on the role of owner identities in strategic decision-making (e.g., Thomsen & Pedersen, 2000; Connelly et al., 2010). Specifically, we clarify how the unique identity and preferences of family blockholders shape legitimacy and reputation concerns and, as a result, ecological corporate entrepreneurial efforts.

THEORY AND HYPOTHESES

Institutional Pressures for Ecological Sustainability

Eco-innovations are situated at the intersection of corporate entrepreneurship and corporate sustainability, and represent an important way by which firms can reduce their ecological footprint (Carrillo-Hermosilla et al., 2010; Kesidou & Demirel, 2012). Although eco-innovations, as most forms of corporate entrepreneurship, tend to require investments that are rather risky and long-term in nature, their impact on the natural environment is generally more substantial compared to standardized environmental practices or off-the-shelf technologies (Berrone et al., 2013). Eco-innovations are part of the broader theme of corporate sustainability, in which a systems logic prevails and firms are regarded as systems nested within larger systems including the natural environment (Slawinski & Bansal, 2015). The relentless pursuit of profit maximization by firms throughout the supply chain, production, and product life stages, without any consideration of ecological issues, is said to create environmental imbalances which
ultimately undermine the functioning of firms as nested systems (Bansal & Song, 2017).

Recently, business scholars have started to explore situations in which particular environmental practices may even strengthen a firm’s financial position, for instance through product differentiation or cost savings in energy and materials (e.g., Ambec & Lanoie, 2008; Porter & Kramer, 2011). Yet, an exclusive focus on financially rewarding environmental practices promotes cherry-picking in lieu of more comprehensive sustainability approaches, and it seems that companies are often motivated to go green even in the absence of direct financial rewards (Bansal & Roth, 2000; Bansal & Song, 2017).

When studying ecologically sustainable behavior by firms, scholars often rely on institutional theory (e.g., Delmas & Toffel, 2008; Berrone et al., 2013). A key insight from institutional theory is that, next to considerations of efficiency and performance, firm decision-makers can adopt particular practices first and foremost because they enhance the legitimacy and reputation of the firm (Di Maggio & Powell, 1983; Selznick, 1996). That is, firm decision-makers may experience institutional pressures (e.g., cultural expectations, professional norms) to which they succumb such that their firm is acknowledged as legitimate and reputable (Di Maggio & Powell, 1983). In turn, this legitimacy has instrumental value for firms, since without it they would lose the support from critical stakeholders which, in the long run, may put firm survival at risk (Scott, 1987). For instance, companies with an unfavorable reputation experience difficulties in attracting resources and in retaining clients and personnel and they are often subject to unforgiving public and regulatory scrutiny (DiMaggio & Powell, 1983; Bansal & Clelland, 2004; Berrone et al., 2013). In our study, the institutional perspective is valuable for two main reasons. First, institutional theory’s focus on legitimacy as a key driver of firm behavior makes it “particularly attractive (…) since ‘green investments’ often cannot be financially justified, at
least in the short term” (Berrone et al., 2013: 893). Second, this concern for legitimacy and reputation will allow us to clarify the distinctiveness of family-owned firms in relation to eco-innovations.

Over the past decades, there has been an upsurge in environmental consciousness in the public domain (Flammer, 2013). These environmental concerns have permeated the corporate arena, where many investors, B2B clients and end consumers now consider the ecological performance of the firms they deal with (e.g., Jiang & Bansal, 2003; Ambec & Lanoie, 2008). Nowadays, firm decision-makers face considerable institutional pressures for greater ecological responsibility (Delmas & Toffel, 2008), and one particularly persuasive way by which firms can demonstrate their commitment to ecological sustainability is by introducing eco-innovations.

Compared to other environmental practices, such as the formation of an environmental board committee or the adoption of a standardized environmental management system, eco-innovations are less likely to be symbolic and more likely to be substantive in nature and may thus be welcomed with less skepticism by external stakeholders (Jiang & Bansal, 2003; Berrone & Gomez-Mejia, 2009). Also, “unlike other environmental practices that are often off-the-shelf alternatives oriented toward meeting minimal environmental standards and that can be obtained in the open market” (Berrone et al., 2013: 891), companies’ tailor-made eco-innovations tend to have a stronger impact on environmental performance, which likely confers greater legitimacy (Berrone & Gomez-Mejia, 2009; Berrone et al., 2013).

While earlier institutional work emphasized how firms’ concern for their legitimacy and reputation would lead to isomorphism among organizations (DiMaggio & Powel, 1983), more recent institutional writings adopt the view that firms can vary significantly in how they respond to institutional pressures (Oliver, 1991; Greenwood & Hinings, 1996; Scott, 2008), including
pressures for ecological sustainability (Delmas & Toffel, 2008; Berrone et al., 2013). Indeed, how companies respond to external institutional pressures varies with internal firm characteristics including the beliefs and preferences of those in power (Greenwood & Hinings, 1996; Hoffman, 2001). In what follows, we investigate how the presence of a family with a controlling ownership stake affects firms’ responsiveness to institutional pressures for ecological sustainability. To develop this argument, we will complement institutional theoretic arguments with insights from socioemotional wealth theory on the preferences of owning-families.

**Family Ownership and Concern for Reputation**

Rooted in the behavioral tradition, socioemotional wealth (SEW) theory offers a framework for analyzing the nonfinancial drivers of family firm decision-making (Gomez-Mejia et al., 2007; Gomez-Mejia et al., 2011). Although this theory is still in its nascent stage, it offers several key insights on the distinctiveness and heterogeneity of family-owned firms. First, SEW scholars highlight the nonfinancial or so-called socioemotional utility that parties derive from business ownership, and claim that this nonfinancial utility serves as the primary reference point in decision-making by owning-families (Gomez-Mejia et al., 2011). This distinguishes family-owned firms from nonfamily firms in which, it is argued, financial considerations typically dominate and nonfinancial utility is of subordinate importance. Second, SEW scholars have started to delineate specific socioemotional dimensions and to map the correlates of these dimensions (Berrone, Cruz & Gomez-Mejia, 2012; Brinkerink & Bammens, 2017). Compared to earlier work, in which socioemotional wealth was treated as a monolithic construct, the delineation of SEW dimensions increases the predictive power of SEW-based models. Examples of SEW dimensions that emerged from this research include the utility that owning-families
derive from having discretion in decision-making (family control), from being altruistic toward relatives via the business (family altruism), from being associated with a respected business and the status it entails (family reputation), and from being able to continue the family dynasty through an intended transfer of the business to future family generations (family dynasty) (Gomez-Mejia et al., 2011; Berrone et al., 2012; Brinkerink & Bammens, 2017).

Several prior studies on innovation-related decisions in a family firm context have applied a SEW theoretic lens, with most of them pointing to negative implications of owning-families’ SEW considerations for innovation. Although the multiplicity of SEW dimensions likely has a complex effect on innovation decisions (Souder et al., 2017), the most recurring SEW argument refers to families’ preoccupation with preserving control over firm decisions and operations. Indeed, many scholars have argued that the reluctance of families to cede significant influence to outside investors, lenders, professional managers or business partners negatively affects aspects like R&D spending, R&D contracting, innovation partner variety, new technology adoption, and patent citations (e.g., Chrisman & Patel, 2012; Classen et al., 2012; Block et al., 2013; Kotlar et al., 2013; Gomez-Mejia et al., 2014; Souder et al., 2017). Building on our discussion of institutional theory, with its focus on the legitimacy and reputation derived from ecologically sustainable practices (Berrone et al. 2013), we posit that there is something distinctive about eco-innovations as they allow owning-families to enhance their SEW.

As pointed out by Berrone and colleagues (2010: 88), “family owners should place a greater value on the legitimacy afforded by environmental initiatives because doing so would safeguard their socioemotional wealth”. We argue that families’ heightened sensitivity to the legitimacy and reputation of their firm is anchored in two SEW dimensions, namely family reputation and family dynasty. First, owning-families are not faceless owners but, instead, people
often know the family name behind the family firm and view the firm as an extension of the family (Cruz et al., 2014). As a consequence, the reputation and social standing of the owning-family is closely tied to the reputation of the family firm (Gomez-Mejia et al., 2011). Lagging behind in environmental performance would be associated with a less favorable firm reputation, thereby harming the family’s reputation and thus the socioemotional wealth it derives from its business ownership (Dyer & Whetten, 2006; Berrone et al., 2010). Conversely, taking environmentally friendly initiatives by introducing eco-innovations – which are less likely to be interpreted as cosmetic or greenwashing by stakeholders compared to other environmental practices (Berrone et al., 2013) – reflects favorably on the firm and the family and enhances their reputation in the community (Dekker & Hasso, 2016; Le Breton-Miller & Miller, 2016).

Second, families regularly have the intention to pass the business on to the next generation to preserve the family dynasty (Berrone et al., 2012; Brinkerink & Bammens, 2017). As such, they are particularly concerned with organizational resilience, which refers to a firm’s ability to persist through disturbances and to endure over the long run (DesJardine, Bansal & Yang, 2017). A critical element contributing to organizational resilience is a firm’s reputation and its “social license to operate” (Ortiz-de-Mandojana & Bansal, 2016; DesJardine et al., 2017). Indeed, institutional writers emphasize the value of a firm’s legitimacy for its long-term survival by ensuring continued stakeholder support and by acting as a goodwill buffer in times of crisis (Scott, 1987; Bansal & Roth, 2000; Bansal & Clelland, 2004). By engaging in eco-innovations, family-owned firms can enhance their legitimacy and reputation, and thus strengthen the firm’s organizational resilience and its prospect of persisting over family generations. Current environmental practices may have long-lasting reputational effects and even affect the firm’s legitimacy in the next generation (Schrempf-Stirling, Palazzo & Phillips, 2016), which should
make family firms with dynastic ambitions particularly interested in the reputational benefits of eco-innovations.

In sum, based on institutional theory we argue that the potential for strengthening the firm’s reputation represents one of the key drivers of eco-innovations; and based on socioemotional wealth theory we argue that, compared to nonfamily firms, family-owned firms are more concerned with strengthening their ecological reputation as it relates directly to the SEW dimensions of family reputation and family dynasty. To date, little research has been devoted to the topic of eco-innovations in a family firm context, yet the broader topic of ecologically sustainable practices has received growing attention among family business scholars and several prior findings are in line with our theoretical arguments (e.g., Craig & Dibrell, 2006; Dyer & Whetten, 2006; Berrone et al., 2010; Campopiano & De Massis, 2015). We thus propose that family ownership is positively associated with firms’ engagement in eco-innovation, and that this effect is mediated by concern for the potential reputation gains derived from such green behavior. Note that we expect this to represent a partial mediation mechanism (rather than a full mediation mechanism) given the multitude of possible SEW dimensions (Berrone et al., 2012; Brinkerink & Bammens, 2017) and the variety of drivers of green behavior (Bansal & Roth, 2000; Kesidou & Demirel, 2012). This results in our first set of associated hypotheses:

**Hypothesis 1a:** Compared to nonfamily firms, family-owned firms demonstrate higher levels of engagement in eco-innovation.

**Hypothesis 1b:** The effect of family firm status on engagement in eco-innovation is partially mediated by concern for potential company reputation gains derived from such engagement.
Family Firm Heterogeneity: A Look at Contingency Factors

Scholars have long recognized that family firms do not represent a homogenous organizational form. In fact, it has been suggested that the two central research questions in the family business field relate to clarifying family firm distinctiveness (i.e., differences between family versus nonfamily firms) and family firm heterogeneity (i.e., variance within the group of family firms) (e.g., Chrisman, Steier & Chua, 2006). The need to develop a deeper understanding of family firm heterogeneity is evident from the many conflicting findings observed in prior research on family firms’ innovation and sustainability practices. For instance, in relation to innovation, some observed that family influence is associated with greater innovation efficiency and more patent citations (Matzler et al., 2015; Duran et al., 2016), whereas others found the opposite (Block et al., 2013; Diéguez-Soto, Manzaneque & Rojo-Ramirez, 2016). Similarly, in relation to ecological sustainability, some found a positive effect of family influence (e.g., Dyer & Whetten, 2006; Berrone et al., 2010), whilst others observed a negative effect (Rees & Rodionova, 2015).

Interestingly, and contrary to our main effect arguments, one of the few studies on family influence and eco-innovations reports a negative association using a sample of listed Taiwanese firms (Huang, Yang & Wong, 2016). These divergent findings point to the importance of accounting for variation within the group of family-owned firms.

In the discussion above, we related the value that family-owned firms attach to their ecological reputation to the SEW dimensions of family dynasty and family reputation. In what follows, we propose that the salience of these two SEW dimensions in family firm decision-

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4 This finding is corroborated by Rees and Rodionova’s (2015: 194) sensitivity analysis of specific environmental sub-dimensions. Both Huang and colleagues (2016) and Rees and Rodionova (2015) use samples of publicly-listed firms, in which the ‘restricted SEW’ perspective (see below) is more likely to prevail (Le Breton-Miller et al., 2011).
making is contingent on owning-families’ transgenerational intentions and local embeddedness, respectively. Our ideas relate to Miller and Le Breton-Millers’ (2014) distinction between extended and restricted SEW priorities. Extended SEW priorities prevail when families look beyond short-term parochial interests of current family members, and consider the needs and views of future family generations and of nonfamily stakeholders (Miller & Le Breton-Miller, 2014). Many of the depictions of family-owned firms by scholars fit this extended SEW perspective (e.g., Miller et al., 2008; Kappes & Schmid, 2013), and priorities include “investing in a firm to enhance a family’s reputation with stakeholders, forming sustaining relationships with partners to increase the chances of firm survival, and investing in the community to ensure an abundance of goodwill toward the family and its business” (Miller & Le Breton-Miller, 2014: 717). Conversely, restricted SEW priorities prevail when owning-families put emphasis on near-term parochial interests of the immediate family, which may harm the interests of nonfamily stakeholders and the robustness of the firm in the long run (Miller & Le Breton-Miller, 2014). Several of the characterizations of family-owned firms in the literature fit this restricted SEW perspective, and priorities include the entrenchment of family leaders regardless of qualifications to preserve control and altruistic behavior toward offspring in the form of perks and privileges (e.g., Schulze et al., 2001; Le Breton-Miller et al., 2011). The SEW dimensions of family dynasty and family reputation are closely associated with the extended SEW perspective as they foster farsighted and inclusive decision-making (Miller & Le Breton-Miller, 2014).

The first contingency factor we consider relates to the SEW dimension of family dynasty and captures owning-families’ intention to pass the business on to future family generations (Berrone et al., 2012). Transgenerational intentions lengthen family firm decision-makers’ time horizon and represent a critical element in the extended SEW perspective (Kappes & Schmid,
Yet, not all owning-families have such transgenerational intentions. Indeed, in the words of Zellweger and colleagues (2012: 855), “some family firms are “born” with transgenerational control intentions. For other firms such intentions are often triggered later in their life cycles by precipitating events such as when the owner becomes a parent, when a family member becomes involved in the firm, or when an involved family member expresses a desire to do so on a permanent basis […] [T]he absence of family members able and willing to assume control can erase such intentions”. Accordingly, rather than assuming that transgenerational intentions are an inherent feature of all family firms, we follow Chrisman and Patel (2012) by modeling the presence of these intentions as a key source of family firm heterogeneity.

Above we argued that dynastic intentions are associated with greater concern for organizational resilience which, in turn, causes a stronger emphasis on the firm’s legitimacy and the reputation gains it can derive from engagement in eco-innovation (Berrone et al., 2012; DesJardine et al., 2017). We claim that families without transgenerational intentions are less preoccupied with organizational resilience, and put less emphasis on building a favorable ecological reputation for the firm to bolster goodwill and ensure long-term support from critical stakeholders (Bansal & Roth, 2000; Bansal & Clelland, 2004; Chrisman & Patel, 2012; Ortiz-de-Mandojana & Bansal, 2016). The absence of transgenerational intentions will also make families less concerned about the implications that current environmental practices may have for the legitimacy of the firm in the distant future (cf. Schrempf-Stirling et al., 2016). These arguments are in line with Delmas and Gergaud (2014), who observed a positive link between the presence of transgenerational intentions among family owners and the extent of eco-certified production in a sample of Californian wineries. This leads to the next set of associated hypotheses:
Hypothesis 2a: The positive association between family ownership and concern for potential company reputation gains derived from engagement in eco-innovation is weaker when owning-families have no transgenerational intentions.

Hypotheses 2b: Transgenerational intentions moderate the mediated effect of family firm status on engagement in eco-innovations, such that the mediated effect is weaker when owning-families have no transgenerational intentions.

Local embeddedness represents the second contingency factor we consider in our model. It refers to the extent to which owners reside in the local community to which the firm belongs (cf. Niehm, Swinney & Miller, 2008) and is connected to the SEW dimension of family reputation. Many corporate environmental practices have, first and foremost, a significant impact on the local community in which the firm is located, such as air, water, soil or noise pollution. Local community actors therefore tend to closely monitor firms’ environmental performance and can exert strong and directed institutional pressures, for instance by organizing neighborhood activism, attracting local media attention, and filing lawsuits (Berrone et al., 2010). As such, the local community represents a central stakeholder in relation to firms’ environmental practices, and the ecological reputation of companies is strongly affected by this stakeholder group’s observations and assessments (Campopiano & De Massis, 2015; Dekker & Hasso, 2016). Stated differently, a firm’s ecological reputation has a considerable local component.

Earlier we argued that family-owned firms will be more sensitive to reputational concerns because the firm’s reputation is closely tied to the family’s reputation. We expect this will play out most strongly when the owning-family is locally embedded, since boundaries between the family and the firm are then more blurred, family owners are well-known in the community, and
local community actors may see environmental negligence “as a personal betrayal and not just an unsavory business decision, and this stigma may be felt first-hand by family members in school, at church, in social gatherings, and so on” (Berrone et al., 2010: 90; Dekker & Hasso, 2016). Conversely, when members of the owning-family reside in areas more distant from the firm’s location, they will be buffered from these dynamics; that is, local community actors are less likely to project their negative views on distant and less known owners, and the distant communities in which these family owners reside may be unaware of the firm’s environmental practices. In this case, owning-families will be less concerned about the firm’s reputation with its local stakeholders and may include their ecological concerns to a lesser extent in firm decision-making, which deviates from the extended SEW perspective (Miller & Le Breton-Miller, 2014). In sum, we propose that a firm’s ecological reputation has a strong local component and that, as the owning-family’s local embeddedness weakens, it gets increasingly decoupled from the reputation family members experience within the social context in which they live. This results in our final set of associated hypotheses:

**Hypothesis 3a:** The positive association between family ownership and concern for potential company reputation gains derived from engagement in eco-innovation is weaker when owning-families are not locally embedded.

**Hypothesis 3b:** Local embeddedness moderates the mediated effect of family firm status on engagement in eco-innovations, such that the mediated effect is weaker when owning-families are not locally embedded.
DATA AND METHODS

To test our hypotheses, we collect data from the German part of the Community Innovation Survey (CIS), a European-wide survey of innovation activities in the business sector on behalf of the European Commission. In Germany, the survey is administered as an annual panel data set, which periodically includes additional survey questions for the purpose of academic and policy research. We build our analysis on two such sets of questions concerning family ownership and environment-friendly innovations in the 2015 wave of the panel. For our purposes, CIS data has the advantage that it covers all manufacturing industries, plus those service industries in which a majority of innovation activity is expected to take place (e.g., financial intermediation, IT services, or technical engineering). Moreover, the sample is statistically representative for these industries and therefore allows extrapolations to the economy as a whole. After omitting observations due to item non-response, our final data set includes 4009 firms.

Outcome Variable

The 2015 wave of the German CIS includes survey questions on R&D and innovations with environmental benefits. From these survey items, we are able to record whether firms adopted any process innovations between 2012 and 2014 that

- reduced the energy consumption per unit of output or operation,
- reduced the material or water consumption per unit of output or operation,
- reduced CO₂ emissions per unit of output or operation,
- reduced other air emissions (e.g., SOₓ, NOₓ),

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5 The German CIS is collected by the Centre for European Economic Research (ZEW) in Mannheim and therefore also goes by the name of Mannheim Innovation Panel. See: http://www.zew.de/en/forschung/mannheim-innovation-activities-of-german-enterprises/.
6 We checked whether case-wise deletion affects representativeness but found only small differences in means and quartiles with respect to firm size, age, and location.
• reduced water or soil pollution,
• reduced noise pollution,
• replaced fossil with renewable energy sources,
• replaced dangerous materials and substances,
• promoted recycling of waste, water or materials for own use or sale.

Furthermore, we collect information on whether firms introduced any product innovations between 2012 and 2014 that

• reduced the energy consumption,
• reduced the air, water, soil or noise emissions,
• improved the recyclability after use,
• extended the lifetime,

of their products or services. We then construct dummies from each individual item and sum them up for each firm in our sample. The resulting variable Eco-innovations ranges from zero to 13, with a mean of about 3 and a standard deviation of 3.4 (see Table 1).

**Independent Variables**

Our treatment variable, Family-owned, is a dummy which records whether at least 50 percent of a firm is owned by a family. According to this definition, about 60 percent of the firms in our sample are categorized as being family-owned, which is in line with the average at the European level (European Commission, 2009). Table 1 presents split sample statistics with respect to family firm status. A test on mean differences reveals that family-owned firms in our sample show a significantly higher score of Eco-innovations.

To test our mediation hypothesis, we collect information on how important the concern for improving a firm’s reputation was as a factor influencing the decision to introduce eco-innovations. The resulting variable Reputation Concern is coded on a 4-point Likert scale: not relevant (0), low importance (1), medium importance (2), and high importance (3). Its mean in
the overall sample is about 0.68. On average, family-owned firms score significantly higher (0.72 compared to 0.62).

We construct our two moderating variables as follows. *Transgenerational Intentions* is a dummy equal to one if family-owned firms state that a transfer of the firm to the next family generation is intended, and zero otherwise. Constructed in that way, as *Transgenerational Intentions* is zero for non-family firms, the product *Family-owned* × *Transgenerational Intentions* is equivalent to *Transgenerational Intentions* alone. The product term is therefore omitted in our empirical models. About 48 percent of the family-owned firms in our sample are intended to be transferred to the next generation.

In order to measure whether firm owners are locally embedded in the firm’s community, we supplement our data with address information of firm owners. We retrieve this information from *Creditreform* which is Germany’s largest credit rating agency and has a business model comparable to that of *Dun & Bradstreet* in the U.S. We then geocode both the home address of owners and the company’s registered office address with the help of the R-package “ggmap”. This package provides functionality to repeatedly query the Google Maps API and extract geographic coordinates for an array of input strings that contain address information. Subsequently, we compute the shortest distance (or, great-circle-distance) between home and company addresses based on the “haversine method”. Following these steps, we are able to measure the average distance between owners’ places of residence (we record 2.4 owner

7 The haversine formula computes shortest paths on a sphere and therefore does not account for the ellipsoidal shape of the earth. The resulting inaccuracies do not have any practical implications for our analysis though.
observations per firm, on average) and registered office addresses for 2890 firms in our sample.\(^8\) To avoid a disproportionate influence of outliers, we winsorize distances at 150 kilometers per owner. The variable *Locally Embedded* is then constructed as a dummy equal to one if the average distance between owners’ residences and a firm’s registered office address is less than 30 kilometers, and zero otherwise. This particular threshold is motivated by the fact that the average size of a *Landkreis*, the primary administrative unit in Germany (corresponding to NUTS 3 level in the European classification\(^9\)), in 2015 was equal to about 1000 square kilometers.\(^10\) Given this definition, about 84 percent of firms in our sample can be categorized as having locally embedded owners. We explore the robustness of our analysis to other distance thresholds in a subsequent section.

Throughout our estimations we employ a set of control variables. *Large Firm*, is a dummy equal to one if a firm has more than 250 employees, which corresponds to the definition for small and medium-sized enterprises (SME) in the EU. The high percentage of SMEs, equal to about 89 percent, underscores the representativeness of our sample. Furthermore, we control for the age of a firm (*Age*), which is about 34 years on average. Additional control variables are *Exporter*, a dummy recording whether firms sell to customers outside Germany, and *Group*, signifying whether a firm is part of a corporate group. Due to the communist regime of the GDR from 1949 to 1990, Germany’s new federal states have a considerably different history with

\(^{8}\) This drop in sample size can be explained by the fact that we require firm owners to be natural persons that are either personally liable or hold an equity stake in the company. Information on owners according to this definition was unfortunately not available for all firms in our initial sample.

\(^{9}\) [http://ec.europa.eu/eurostat/web/nuts](http://ec.europa.eu/eurostat/web/nuts)

\(^{10}\) Based on own calculations. Data obtained from the German statistical office: [https://de.statista.com/](https://de.statista.com/).
respect to private company ownership. We therefore control for whether a firm is located in East Germany. Finally, we include a set of 21 industry dummies in our estimations.

Nonlinear Moderated Mediation Analysis

As our outcome variable, Eco-innovations, is a count and our mediator variable, Reputation Concern, is ordinal, standard linear mediation models are unsuitable for our analysis (Imai et al., 2011). Nonlinearity introduces two complications in mediation analysis: marginal effects are not constant anymore and depend on the value of other covariates, and relatedly, mediation effects cannot be computed by a product of coefficients, as in the linear case (Baron and Kenny, 1986; MacKinnon, 2008). A modern stream of literature (Imai et al., 2010a; Imai et al., 2010c; Imai et al., 2011; Imai et al., 2013) discusses identification of causal mediation effects in nonlinear (and non-parametric) models based on the potential outcome framework (Rubin, 1974). The resulting estimation techniques are implemented in the R-package “mediation” (Imai et al., 2010b).

The equations below represent our mediation model

\[ \text{Reputation Concern}_i = f(\text{Family-owned}_i) \]

\[ \text{Eco-innovations}_i = g(\text{Reputation Concern}_i, \text{Family-owned}_i) \]

where the vector control variables \( X_i \) and error terms are omitted for ease of notation. The aim of a mediation analysis is then to decompose the total (average causal) effect of Family-owned on Eco-innovations into an average causal mediation effect (ACME), working on the mediation path, Family-owned \( \rightarrow \) Reputation Concern \( \rightarrow \) Eco-innovations, and a remaining average direct effect (ADE). Such a decomposition allows to determine the causal mechanisms by which family
ownership exerts its influence on the adoption of environment-friendly innovations. The “mediation” package offers researchers a high degree of flexibility in choosing suitable statistical models for their data at hand. We define $f(\cdot)$ such that the mediator is modelled as ordered logit and $g(\cdot)$ such that the outcome follows a poisson model. The ACME and ADE can then be computed from the predicted values of these two models. In addition, following our Hypotheses 2 and 3, we analyze whether the ACME, transmitted through Reputation Concern, differs depending on Transgenerational Intentions and Locally Embedded.

An important result from the modern mediation literature is that the identification of causal mechanisms requires the rather strong assumption of sequential ignorability (Imai et al., 2010c). The name derives from the fact that two ignorability assumptions need to be invoked sequentially. First, given the set of (pre-treatment) control variables $X_t$, the treatment variable (Family-owned) needs to be independent of potential outcomes, which is the standard strong exogeneity assumption from the treatment effects literature (Imbens, 2004). Second, the mediator has to be ignorable (exogenous) conditional on the (pre-treatment) controls $X_t$ and the actual treatment status. Although a detailed technical discussion is beyond the scope of this paper, the strength of this assumptions can be understood intuitively by recognizing that it rules out any post-treatment confounder, whether observed or unobserved, that would establish a connection between the mediator and outcome (Imai et al., 2011, Figures 7 and 8). Imai et al. (2011), however, stress the fact that this assumption is not particular to nonlinear methods but necessary even in standard linear mediation analysis—a fact that was not well-understood in the older literature based on structural equation models. Although sequential ignorability is principally untestable, Imai et al. (2010a,c) developed a sensitivity analysis to assess the robustness of results to a violation of this assumption, which we will present in a subsequent section.
RESULTS

Table 2 reports results of our unmoderated mediation analysis. The total effect of Family-ownership on Eco-innovations is positive and equal to about 0.6, on average. This effect is significant at the 5-percent-level (as the confidence interval excludes zero), which confirms the pattern already visible in the descriptive statistics in Table 1. We thus conclude that Hypothesis 1a is supported. Furthermore, the total effect can be decomposed into an average causal mediation effect (ACME) of about 0.2 and an average direct effect (ADE) of about 0.4, which are both statistically significant. This provides support for Hypothesis 1b, that Reputation Concern mediates the relationship between Family-owned and Eco-innovations. The share of the total effect that is mediated is equal to about 36 percent. The individual estimates for the mediator ordered logit model and the outcome poisson model are reported in Table 4.

Results for our moderation hypotheses are shown in Table 3. Columns 1 and 2 reveal that the ACME differs substantially depending on the value of Transgenerational Intentions. It is significant at the 5-percent-level if Transgenerational Intentions is equal to one, and insignificant otherwise. The difference in ACME (0.269 − 0.127 = 0.142) is significant at the 10-percent-level (p = 0.092). Table 3 further shows that the ACME is significant at the 5-percent-level if Locally Embedded is equal to one, and insignificant otherwise. However, the difference between the ACME in column 4 and 3 is not positive, as hypothesized, and also not statistically different from zero. We therefore conclude that Hypothesis 2b is supported, but Hypothesis 3b is not. In order to assess our a-hypotheses (2a and 3a), we have to look at the
individual mediator models underlying our moderated mediation analysis (Tables 5 and 6\textsuperscript{11}). As mentioned before, marginal effects are not constant in nonlinear models and coefficients can therefore not be interpreted directly. For this reason, in Figures 1 and 2 we present predicted probabilities (averaged over the distribution of covariates) to fall into the four categories of Reputation Concern, conditional on the values of our moderators. Figure 1 shows that the probability to report a high value of Reputation Concern is higher for family firms with transgenerational intentions compared to other firms, and the probability to report low values is lower. This provides clear support for Hypothesis 2a. Furthermore, Figure 2 sheds light on a possible moderating effect of Locally Embedded. First thing to note is that Family-owned seems to increase the probability to report higher levels of Reputation Concern (difference between first and second bar, and third and fourth bar is negative for low levels, and positive for high levels), although confidence intervals have a considerable overlap. However, this effect is not more pronounced if Locally Embedded is equal to one. Thus, there seems to be no evidence for Hypothesis 3a.\textsuperscript{12}

\vspace{1cm}

Insert Tables 2-6 and Figures 1-4 about here

\vspace{1cm}

\textsuperscript{11} Note that our models allow for moderation at both parts of the mediation path (Family-owned \rightarrow Reputation Concern and Reputation Concern \rightarrow Eco-innovations), although moderation is only hypothesized for the first part, to ensure maximal flexibility in fitting the data. Also recall that since Transgenerational Intentions is zero for non-family firms, the product Family-owned \times Transgenerational Intentions is equivalent to Transgenerational Intentions alone and that the product term is therefore omitted in Table 5.

\textsuperscript{12} For completeness, we also report predicted counts for our outcome poisson models depending on Reputation Concern and our moderators in Figures 3 and 4. Interestingly, although the coefficients of the product term Transgenerational Intentions \times Reputation Concern are significantly negative in Table 5, a negative moderation in the second part of the mediation path is not supported by Figure 3. We therefore conclude that the moderation of Transgenerational Intentions happens predominantly in the first part, as hypothesized in H2a.
To conclude, we find clear support for Hypotheses 1a and 1b. Moreover, the effect of Family-owned on the mediator, Reputation Concern, is moderated by Transgenerational Intentions, leading to a higher ACME in total and confirming Hypotheses 2a and 2b. By contrast, moderation of Locally Embedded, according to Hypotheses 3a and 3b, is not supported by our estimation results. To get an idea about the economic significance of these results we first note that our sample represents a total population of about 279000 German firms (Rammer et al., 2016). With a share of 60 percent of family firms and a treatment effect of about 0.6 this implies a total number of about 97000 firms that adopt eco-innovations in an additional category of our outcome scale. Thus, family ownership increases the scope of environmental benefits in these firms. About 35000 of the additional environmental benefits occur because reputational concerns play a more pronounced role for the adoption of environment-friendly products, services and production techniques in family firms (mediated effect).

Robustness Checks and Sensitivity Analysis

Our baseline results do not provide evidence for the mediated effect being moderated by local embeddedness. We check the robustness of this finding by re-estimating our moderated mediation model and only taking into account those innovations that have an immediately perceivable effect on the local eco system. The rationale behind this approach is that the impact of process innovations leading to reductions in air emissions, water or soil pollution, or noise pollution is more easily recognized by the local community and therefore a locally embedded firm, which cares for its reputation, might primarily engage in these types of eco-innovations. However, our robustness check confirms the baseline results and provides no further evidence for moderated mediation. In addition, we check robustness with respect to two different
thresholds for the average distance of firm owners’ residences and firms’ registered office addresses in the construction of *Locally Embedded* (15 and 60, instead of 30 kilometers). In both cases, our baseline results remain qualitatively unchanged (detailed estimation results for our robustness checks are available from the authors upon request).

An important finding from the family business literature is that family ownership can affect innovation spending (Chrisman & Patel, 2012). At the same time, innovation spending will have an effect on a firm’s engagement in eco-innovation. This creates a second causal mechanism via which family ownership affects our outcome variable. Imai et al. (2011) discuss mediation analysis with multiple causal mechanisms. An important finding from this literature is that the causal mediation effect can be estimated consistently as long as a (possibly unobserved) second mediator is not causally affecting both the main mediator of interest and the outcome (Imai et al., 2011, Figure 8).\(^\text{13}\) We can apply this result to our case by arguing that although innovation spending affects eco-innovations (*Innovation Spending* → *Eco-innovations*), it is implausible that there is a direct causal link between innovation spending and a firm’s reputation concern (*Innovation Spending* → *Reputation Concern*). In that case, our main mediation path of interest, going through *Reputation Concern*, is not affected by the presence of a second mediator. Consequently, our estimates for the ACME are consistent. The causal effect of *Family-owned* on *Eco-innovations* that is transmitted via *Innovation Spending* is then incorporated in our direct effect estimates. Furthermore, a situation in which a firm’s concern for its reputation first affects innovation expenditures, which subsequently exerts an influence on the number of eco-innovations (*Reputation Concern* → *Innovation Spending* → *Eco-innovations*), is also

\(^{13}\)In this case, the second mediator would act as a post-treatment confounder and sequential ignorability would be violated.
unproblematic. In this case, Innovation Spending will partially mediate the main mediation path, but this does not affect the consistency of our ACME estimates. We conclude that accounting for a firm’s innovation expenditures in our analysis is unnecessary to identify the effects of interest.

We also conduct a linear mediation analysis (detailed results are available from the authors upon request), for two reasons. First, we are reassured by the fact that our qualitative results (support for Hypotheses 1 and 2, no support for Hypothesis 3) remain unchanged if we apply the traditional linear approach to mediation. Second, Imai et al. (2010a,c) develop a sensitivity analysis for the violation of sequential ignorability under linearity. In linear models, sequential ignorability implies zero correlation between the errors of the mediator and outcome model (Imai et al., 2011, p. 773). A sensitivity analysis entails to depart from this assumption by introducing a non-zero error correlation ρ (sensitivity parameter), which would render the mediator endogenous. Assuming different values of ρ, the mediation analysis is then repeated and estimates are compared with the baseline (see Figure 5). It can be seen that our results are quite robust to violations of sequential ignorability. Only for rather large correlations of above 0.4 (in absolute values) the estimated ACME and ADE would vanish, which strengthens our confidence in our results.

insert Figure 5 about here

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DISCUSSION

This study advances insight on the intricate and multifaceted association between family ownership and a key component of corporate entrepreneurship, namely a firm’s innovation behavior. Whereas most prior research highlighted the conservative and resource-constrained
nature of family-owned firms, our study contributes to the identification of particular innovation domains in which these firms outperform their nonfamily counterparts. Eco-innovations are a peculiar type of innovation in that one of the primary reasons why firms engage in eco-innovation concerns the potential for reputation gains given strong institutional pressures for ecological sustainability (Berrone et al., 2013). Owing-families’ concern for building and protecting SEW makes them more sensitive to such potential reputation gains. Interestingly, our findings on the positive impact of family ownership on eco-innovations contradict prior empirical research (Rees & Rodionova 2015; Huang et al., 2016). A provisional explanation can be found in the fact that the vast majority (over 99.9 percent) of our sampled firms are privately-held firms, whereas Rees and Rodionova (2015) and Huang and colleagues (2016) sampled publicly-listed firms, for which the restricted rather than the extended SEW perspective (cf. Miller & Le Breton-Miller, 2014) is more likely to prevail. Indeed, in large publicly-listed firms the distance between the family and the firm is larger, which may result in owning-families being more inclined to pursue short-term parochial family interests (Le Breton-Miller et al., 2011).

This study also contributes to our understanding of family firm heterogeneity. Rather than assuming that all family firms are characterized by transgenerational intentions, we modeled and tested its role as a key differentiator. We found that the mediated effect of family ownership on firm-level engagement in eco-innovation differs significantly depending on whether or not the owning-family has dynastic ambitions. In our representative sample of German enterprises, less than half of the companies controlled by a family have transgenerational intentions, and without such intentions they do not seem to be more ecologically innovative than nonfamily firms. This finding on the positive role of transgenerational intentions is in line with the work of Delmas and Gergaud (2014) who looked at eco-certification by wineries. However, contrary to our
expectations (cf. Berrone et al., 2010; Dekker & Hasso, 2016), we did not find support for the moderating role of owners’ local embeddedness. Given that we conceptually tied the moderating role of transgenerational intentions to SEW concerns for family dynasty and the moderating role of local embeddedness to SEW concerns for family reputation, these results suggest that, in our sample, SEW concerns for family dynasty represent the dominant rationale for why family-owned firms show greater concern for potential company reputation gains derived from eco-innovations. That is, the desire to transfer the family firm to future generations makes owning-families particularly concerned with organizational resilience and, therefore, with the firm’s legitimacy and reputation among key stakeholders (cf. DesJardine et al., 2017).

By examining eco-innovations this study also contributes to the literature on sustainable practices by family firms. While prior work already proposed that family ownership may come with greater concerns for legitimacy and, thus, greater sensitivity to institutional pressures for ecological sustainability (Berrone et al., 2010), we advance this research stream by modeling and measuring the alleged key mediator – reputation concern – and by revealing how this reputation concern depends crucially on the transgenerational intentions of the owning-family. Furthermore, few prior studies on sustainable practices by family firms examined eco-innovations (notable exceptions are Rees & Rodionova 2015; Huang et al., 2016), which represent a markedly proactive and impactful type of green behavior (Berrone et al., 2013). Our findings also highlight the value of including owner identities in studies on corporate sustainability, which is a topic that thus far attracted relatively little attention from sustainability scholars (Bansal & Song, 2017).

14 It can be noted that our conceptualization and measure of local embeddedness (focused on the geographic distance between owners’ home address and the firm’s office address; i.e., local embeddedness of the owners) deviates from prior approaches which focused on the geographic distance between the firm’s subsidiaries and its headquarters (Berrone et al., 2010) or the geographic scope of the firm’s market operations (Dekker & Hasso, 2016).
This study also has practical implications, in particular for policy-makers. Ecological sustainability is high on the agenda of policy-makers across the globe. Given that family-owned firms represent the majority of enterprises in most economies, it is valuable to know how these firms perform in the area of eco-innovation and how their ecological innovativeness can be further stimulated. Our results indicate that, on average, family-owned firms perform well in this area but that their engagement in eco-innovation hinges on the presence of transgenerational intentions. Policy-makers can influence the prevalence of transgenerational intentions among owning-families and, in doing so, indirectly shape firm-level engagement in eco-innovation. One element in environmental policy programs could be, for instance, to reduce tax rates on the transfer of family firm assets and shares through gifts or inheritance as this likely increases the prevalence of intentions for continued family control within the population of family-owned firms. As an illustration, we refer to the favorable tax treatment of the transfer of family firm assets and shares by the Flemish government in Belgium, with a tax rate of zero percent in case of gifts and of (in most cases) three percent in case of inheritance (KPMG, 2016).

This paper has a number of limitations and comes with suggestions for future research. First, based on institutional theory and socioemotional wealth theory, we argued that concern for potential company reputation gains represents a key mediating mechanism between family ownership and engagement in eco-innovation. While we find support for this argument, in our sample reputation concern accounts for approximately one third of the total (positive) effect of family ownership, meaning that two thirds of its effect is accounted for by unmeasured mediators. Given the multitude of SEW dimensions and of drivers of green behavior, this is not surprising and we encourage future research to unravel additional (positive) mediating mechanisms linking family ownership to eco-innovation. Second, as we used data from the
German Community Innovation Survey, we had to rely on the available measures. Specifically, we welcome future research using more fine-grained measures of family ownership (e.g., percentage voting rights) and of transgenerational intentions (e.g., time till planned succession) as well as multi-item scales for measuring concern for company reputation gains. Third, the number of publicly-listed firms in our sample was too small to analyze differences between privately-held and publicly-listed family-controlled firms. In view of prior findings (Rees & Rodionova 2015; Huang et al., 2016), it would be interesting to analyze, both conceptually and empirically, in a systematic manner differences between both settings. In particular, scholars may verify whether the extended SEW perspective is indeed more likely to prevail among private family firms and the restricted SEW perspective among public family firms (cf. Miller et al., 2008; Le Breton-Miller et al., 2011; Miller & Le Breton-Miller, 2014). Lastly, Rees and Rodionova (2015) observed differences across countries in how family ownership affects environmental indicators. Our findings may be specific for the German context, and future research will need to establish the generalizability of our results to other institutional settings. We expect that the favorable effect of family ownership on eco-innovation might be weaker in settings where institutional pressures for ecological sustainability are less predominant.

To conclude, this study was situated at the intersection of corporate governance, corporate entrepreneurship and corporate sustainability. It revealed that owner identities – in casu family ownership – have a significant impact on firms’ innovation behavior aimed at reducing harmful environmental effects. Family-owned firms can be a constructive force in advancing more sustainable forms of development, and such behavior can be encouraged with well-designed policies that promote transgenerational intentions. It is our hope that this study stimulates and guides future academic work on this interesting and societally relevant topic.
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TABLES AND FIGURES

Table 1: Descriptive Statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Full Sample</th>
<th>Split Sample (means)</th>
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<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>Std. Dev.</td>
</tr>
<tr>
<td>Eco-innovations</td>
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<td>3.415</td>
</tr>
<tr>
<td>Family-owned</td>
<td>0.606</td>
<td>0.489</td>
</tr>
<tr>
<td>Reputation Concern</td>
<td>0.684</td>
<td>0.981</td>
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<tr>
<td>Transgen. Intent.</td>
<td>0.291</td>
<td>0.454</td>
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<tr>
<td>Locally Embedded</td>
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<tr>
<td>Large Firm</td>
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<td>33.829</td>
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<td>Group</td>
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<td>East Germany</td>
<td>0.322</td>
<td>0.467</td>
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</table>

Notes: N equal to 4009. Locally Embedded has 1119 missing observations. Last column reports p-values for Welch’s t-test of mean differences.

Table 2: Mediation analysis (unmoderated)

<table>
<thead>
<tr>
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</tr>
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<tbody>
<tr>
<td>Average Causal Mediation Effect</td>
<td>0.205</td>
</tr>
<tr>
<td></td>
<td>[0.055; 0.287]</td>
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<tr>
<td>Average Direct Effect</td>
<td>0.369</td>
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<tr>
<td></td>
<td>[0.17; 0.567]</td>
</tr>
<tr>
<td>Total Effect</td>
<td>0.574</td>
</tr>
<tr>
<td></td>
<td>[0.314; 0.757]</td>
</tr>
<tr>
<td>N</td>
<td>4009</td>
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</table>

Notes: 95% confidence intervals are bootstrapped (with 1000 replications) and reported in squared brackets.

Table 3: Moderated mediation analysis

<table>
<thead>
<tr>
<th>Transgenerational Intentions</th>
<th>Locally Embedded</th>
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<tr>
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<td>= 0</td>
</tr>
<tr>
<td></td>
<td>(1)</td>
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<tr>
<td>ACME</td>
<td>0.127</td>
</tr>
<tr>
<td></td>
<td>[-0.057; 0.228]</td>
</tr>
<tr>
<td>ADE</td>
<td>0.139</td>
</tr>
<tr>
<td></td>
<td>[-0.093; 0.364]</td>
</tr>
<tr>
<td>Total Effect</td>
<td>0.266</td>
</tr>
<tr>
<td></td>
<td>[-0.054; 0.493]</td>
</tr>
<tr>
<td>N</td>
<td>4009</td>
</tr>
</tbody>
</table>

Notes: 95% confidence intervals are bootstrapped (with 1000 replications) and reported in squared brackets.
**Table 4**: Individual models for unmoderated mediation analysis

<table>
<thead>
<tr>
<th>Reputation Concern (mediator):</th>
<th>Coefficient</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Family-owned</strong></td>
<td>0.247</td>
<td>[0.099; 0.387]</td>
</tr>
<tr>
<td><strong>Large Firm</strong></td>
<td>0.786</td>
<td>[0.575; 0.984]</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td>0.001</td>
<td>[-0.001; 0.003]</td>
</tr>
<tr>
<td><strong>Exports</strong></td>
<td>0.578</td>
<td>[0.425; 0.729]</td>
</tr>
<tr>
<td><strong>Group</strong></td>
<td>0.303</td>
<td>[0.14; 0.455]</td>
</tr>
<tr>
<td><strong>East Germany</strong></td>
<td>-0.259</td>
<td>[-0.413; -0.107]</td>
</tr>
</tbody>
</table>

**Intercepts**:  
- “not relevant” to “low”: 0.828  
- “low” to “medium”: 1.641  
- “medium” to “high”: 3.021

**Eco-innovations (outcome):**  
<table>
<thead>
<tr>
<th>Intercept</th>
<th>Coefficient</th>
<th>95% Confidence Interval</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Intercept</strong></td>
<td>0.609</td>
<td>[0.456; 0.767]</td>
</tr>
<tr>
<td><strong>Family-owned</strong></td>
<td>0.125</td>
<td>[0.056; 0.196]</td>
</tr>
</tbody>
</table>

**Reputation Concern:**  
- **low**: 0.831 [0.751; 0.915]  
- **medium**: 1.003 [0.919; 1.084]  
- **high**: 1.131 [1.039; 1.229]  

| **Large Firm** | 0.171       | [0.088; 0.255]          |
| **Age**        | 0.001       | [0; 0.002]              |
| **Exporter**   | 0.106       | [0.031; 0.183]          |
| **Group**      | 0.136       | [0.067; 0.205]          |
| **East Germany** | -0.094      | [-0.163; -0.022]        |

**Notes:** N equal to 4009. Ordered logit as mediator model and poisson as outcome model. “Not relevant” constitutes the base category for Reputation concern. Confidence intervals are bootstrapped with 1000 replications. All estimations include a set of 21 industry dummies.

**Table 5**: Individual models for mediation analysis moderated by Transgenerational Intentions

<table>
<thead>
<tr>
<th>Reputation Concern (mediator):</th>
<th>Coefficient</th>
<th>95% Confidence Interval</th>
</tr>
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<tbody>
<tr>
<td><strong>Family-owned</strong></td>
<td>0.113</td>
<td>[-0.055; 0.284]</td>
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<tr>
<td><strong>Large Firm</strong></td>
<td>0.787</td>
<td>[0.574; 0.992]</td>
</tr>
<tr>
<td><strong>Age</strong></td>
<td>0.001</td>
<td>[-0.001; 0.003]</td>
</tr>
<tr>
<td><strong>Exports</strong></td>
<td>0.569</td>
<td>[0.415; 0.728]</td>
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<tr>
<td><strong>Group</strong></td>
<td>0.298</td>
<td>[0.135; 0.453]</td>
</tr>
<tr>
<td><strong>East Germany</strong></td>
<td>-0.26</td>
<td>[-0.414; -0.107]</td>
</tr>
<tr>
<td><strong>Transgenerational Intentions</strong></td>
<td>0.268</td>
<td>[0.115; 0.419]</td>
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**Intercepts**:  
- “not relevant” to “low”: 0.829  
- “low” to “medium”: 1.645  
- “medium” to “high”: 3.026
Eco-innovations (outcome):

<table>
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<tr>
<td>Intercept</td>
<td>0.628</td>
</tr>
<tr>
<td>Family-owned</td>
<td>0.091</td>
</tr>
<tr>
<td>Locally Embedded</td>
<td>0.028</td>
</tr>
</tbody>
</table>

Reputation Concern:

<table>
<thead>
<tr>
<th>Reputation Concern</th>
<th>Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>low</td>
<td>0.332</td>
</tr>
<tr>
<td>medium</td>
<td>-0.144</td>
</tr>
<tr>
<td>high</td>
<td>0.339</td>
</tr>
</tbody>
</table>

Notes: N equal to 4009. Ordered logit as mediator model and poisson as outcome model. “Not relevant” constitutes the base category for Reputation concern. Confidence intervals are bootstrapped with 1000 replications. All estimations include a set of 21 industry dummies.

Table 6: Individual models for mediation analysis moderated by Locally Embedded

<table>
<thead>
<tr>
<th></th>
<th>Coefficient</th>
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</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>0.556</td>
</tr>
<tr>
<td>Family-owned</td>
<td>0.049</td>
</tr>
<tr>
<td>Transgenerational Intentions</td>
<td>0.321</td>
</tr>
<tr>
<td>Reputation Concern:</td>
<td></td>
</tr>
<tr>
<td>low</td>
<td>0.876</td>
</tr>
<tr>
<td>medium</td>
<td>1.097</td>
</tr>
<tr>
<td>high</td>
<td>1.261</td>
</tr>
<tr>
<td>Large Firm</td>
<td>0.162</td>
</tr>
<tr>
<td>Age</td>
<td>0.001</td>
</tr>
<tr>
<td>Exporter</td>
<td>0.108</td>
</tr>
<tr>
<td>Group</td>
<td>0.129</td>
</tr>
<tr>
<td>East Germany</td>
<td>-0.094</td>
</tr>
</tbody>
</table>

Transgen. Intent. × Reputation Concern:

<table>
<thead>
<tr>
<th>Reputation Concern</th>
<th>Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>low</td>
<td>-0.157</td>
</tr>
<tr>
<td>medium</td>
<td>-0.288</td>
</tr>
<tr>
<td>high</td>
<td>-0.415</td>
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</tbody>
</table>

Eco-innovations (outcome):

<table>
<thead>
<tr>
<th></th>
<th>Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>Intercept</td>
<td>0.628</td>
</tr>
<tr>
<td>Family-owned</td>
<td>0.091</td>
</tr>
<tr>
<td>Locally Embedded</td>
<td>0.028</td>
</tr>
</tbody>
</table>

Reputation Concern:

<table>
<thead>
<tr>
<th>Reputation Concern</th>
<th>Coefficient</th>
</tr>
</thead>
<tbody>
<tr>
<td>low</td>
<td>0.762</td>
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<tr>
<td>medium</td>
<td>1.026</td>
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<tr>
<td>high</td>
<td>1.315</td>
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<tr>
<td>Large Firm</td>
<td>0.036</td>
</tr>
<tr>
<td>Variable</td>
<td>Coefficient</td>
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<tr>
<td>-------------------------------</td>
<td>-------------</td>
</tr>
<tr>
<td>Age</td>
<td>0.001</td>
</tr>
<tr>
<td>Exporter</td>
<td>0.073</td>
</tr>
<tr>
<td>Group</td>
<td>0.217</td>
</tr>
<tr>
<td>East Germany</td>
<td>-0.116</td>
</tr>
<tr>
<td>Family-owned × Locally Embedded</td>
<td>0.078</td>
</tr>
</tbody>
</table>
| Locally Embedded × Reputation Concern
  low                          | 0.13        | [-0.167; 0.404]     |
  medium                       | -0.035      | [-0.294; 0.224]     |
  high                         | -0.212      | [-0.498; 0.052]     |

Notes: N equal to 2890. Ordered logit as mediator model and poisson as outcome model. “Not relevant” constitutes the base category for Reputation concern. Confidence intervals are bootstrapped with 1000 replications. All estimations include a set of 21 industry dummies.

**Figure 1:** Predicted probabilities to fall into categories of Reputation Concern (mediation analysis moderated by Transgenerational Intentions)

![Graph showing predicted probabilities](image1)

Notes: Predicted probabilities based on ordered logit (mediator) model presented in Table 5. Error bars depict bootstrapped (1000 replications) 95% confidence intervals.

**Figure 2:** Predicted probabilities to fall into categories of Reputation Concern (mediation analysis moderated by Locally Embedded)

![Graph showing predicted probabilities](image2)

Notes: Predicted probabilities based on ordered logit (mediator) model presented in Table 6. Error bars depict bootstrapped (1000 replications) 95% confidence intervals.
**Figure 3:** Predicted number of eco-innovations for categories of *Reputation Concern* (mediation analysis moderated by *Transgenerational Intentions*)

![Figure 3](image)

*Notes:* Predicted values based on poisson (outcome) model presented in Table 5. Error bars depict bootstrapped (1000 replications) 95% confidence intervals.

**Figure 4:** Predicted number of eco-innovations for categories of *Reputation Concern* (mediation analysis moderated by *Locally Embedded*)

![Figure 4](image)

*Notes:* Predicted values based on poisson (outcome) model presented in Table 6. Error bars depict bootstrapped (1000 replications) 95% confidence intervals.

**Figure 5:** Sensitivity analysis

![Figure 5](image)

*Notes:* Sensitivity of the estimated ACME and ADE, for steps of 0.1 in sensitivity parameter p. Grey areas depict 95% confidence intervals (bootstrapped, 1000 replications). Dashed lines depict point estimates under sequential ignorability. Sensitivity analysis was conducted using the “medsens” function of the “mediation” R-package (Imai et al., 2010b), which does not yet allow for ordered logit and poisson models. Therefore, we rely on linear mediation results for assessing sensitivity (detailed results available from the authors upon request).