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# Emergence of entrepreneurial populations: a feature dimensionality approach

Min Liu ⬤ · Arjen van Witteloostuijn

**Abstract** This paper studies how increasing dimensionality in a market space feeds into the emergence of a sustainable entrepreneurial population—energy cooperatives in Germany. Our theoretical model conceptualizes the market as a multi-dimensional feature space and offers insights as to when and where new types of entrepreneurial activities emerge. We demonstrate that (1) the rise of a socio-cognitive dimension greenness created novel social demand and opened opportunities for sustainable entrepreneurship and (2) sustainable entrepreneurial organizations are more likely to be founded in communities with higher local demand for greenness. Our paper contributes to research on entrepreneurial population emergence and sustainable entrepreneurship.

**Keywords** New entrepreneurial population · Feature dimensionality · Organization ecology · Sustainable entrepreneurship

**JEL classification** D22 · L26 · L94 · M13

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## 1 Introduction

This paper deals with two central questions in entrepreneurship research: When and where do novel types of entrepreneurial activities emerge? Entrepreneurship can be associated with two very different innovation events (Aldrich and Ruef 2006): (1) operating within an institutionalized context and existing population, where entrepreneurs can copy established practices (i.e., reproducer) and (2) striking out in uncharted territory with fuzzy population boundaries, where entrepreneurs pioneer practices without precedents and may become the source of an entirely new organizational population (i.e., innovator). We are interested in the second type of entrepreneurship, where founders of these very innovative ventures face great uncertainties and must overcome dire challenges, such as lack of legitimacy and knowledge (Aldrich and Fiol 1994; Aldrich and Martinez 2001). In spite of its theoretical and practical significance, the emergence of new entrepreneurial populations remains relatively neglected in the entrepreneurship literature (Chandler and Lyon 2001; Davidsson and Wiklund 2001; Forbes and Kirsch 2011).

Within extant research on the emergence of entrepreneurial populations, two theoretical approaches, by and large, can be distinguished: the supply-side and demand-side perspectives. The first stream of work dominates the theoretical landscape and examines the supply of resources necessary to fuel emerging entrepreneurial activities (Thornton 1999). We have learned that a wide range of factors, such as social ties (Stuart and Sorenson 2003), social movements (e.g., Çakmaklı-

Divarci et al. 2017, 2018; Sine and Lee 2009; Weber et al. 2008), and shifting R&D productivity (Bhaskarabhatla and Klepper 2009; Buenstorf and Klepper 2010; Klepper and Thompson 2006), affect the supply of resources crucial for entrepreneurial activities, which can be conducive to establishing new entrepreneurial populations.

In contrast, the second (small) stream of research takes a demand-side perspective, investigating how new entrepreneurial populations emanate under changing social demand. Building on the resource partitioning theory, Carroll and Swaminathan (2000) argue that a craft brewery population came to flourish in the US brewery market because the organizational identities of the incumbent mass producers fail to fit with consumer's growing demand for authenticity. Similarly, applying a community ecology lens, Ruef (2000) reveals that industry participants' rising attention for novel identity attributes creates social demand for new organizational populations in the healthcare sector. In both cases, shifting preferences at the demand side create untapped demand in new niches, opening gateways for novel entrepreneurial activity.

Aiming to further develop this embryonic demand-side perspective, our feature dimensionality approach conceptualizes a market as a multi-dimensional socio-cognitive space in which each feature dimension represents a critical aspect of social demand from resource holders (Garcia-Diaz et al. 2013; Péli and Nooteboom 1999). This theoretical approach offers two major advantages for addressing the question of entrepreneurial population emergence. First, because it models the socio-cognitive space of the critical resource holders (e.g., consumers, investors, gatekeepers, suppliers, and regulators), it enables us to study demand for attributes related to the identities of *potential* entrepreneurial populations. The demand created by changing socio-cognitive dimensionality is thus directly linked to the latent carrying capacity for entrepreneurial activities, which predates the emergence of new entrepreneurial populations and new (sub)markets populated by them (Ruef 2000). Second, research indicates that innovative newcomers are more likely to succeed when environmental demand experiences qualitative and substantial changes—i.e., when the very nature of the demand changes (Le Mens et al. 2015; Péli 2009; Péli and Bruggeman 2007). The feature dimensionality approach models the structure of the socio-cognitive space that determines the nature of demand, making it the perfect device to study the conditions under which new entrepreneurial populations are more likely to emerge.

We argue that as the relevance and desirability of a new feature increase, the number of dimensions that define the market space expands with the new feature. The vacant space along the new feature dimension represents unfulfilled social demand, calling for offerings from organizations whose attributes better match the new dimension. According to imprinting theory (Stinchcombe 1965), new venture populations should be more likely to embody the features favored by contemporary social norms as reflected in the new feature dimension. Under the scope conditions of (1) diseconomies of scope for incumbents and (2) demand reaching a minimum threshold, a new entrepreneurial population characterized by the focal feature emerges to occupy the space associated with the vacant feature dimension. In addition, we suggest that entrepreneurial ventures within the new population are more likely to be founded in communities where social demand for the new feature is high. We test our theory on the recent emergence of a sustainable entrepreneurial population (Shepherd and Patzelt 2011): the population of German energy cooperatives (henceforth referred to as ECs) following the rise of social demand for a new feature dimension *greenness*.

Hence, this paper seeks to contribute to research on entrepreneurial population emergence and sustainable entrepreneurship. First, our feature dimensionality approach further develops the demand-side perspective, offering fresh insights as to when new entrepreneurial populations do emerge. By doing so, our model directly addresses society's latent carrying capacity for novelty, informs the environmental conditions under which new entrepreneurial activities are more likely to emerge, and illuminates the underlying opportunity structure for new entrepreneurial populations (Ruef 2000). Second, we show that social demand from critical resource holders is distributed unevenly across market locations (e.g., regions), implying heterogeneous conditions for forming entrepreneurial opportunity beliefs (McMullen and Shepherd 2006) and mobilizing critical resources. This, in turn, informs us where new types of entrepreneurship are more likely to emerge and flourish.

Third, we contribute to sustainable entrepreneurship research by suggesting a socio-cognitive perspective on how social demand for new attributes, such as environmental friendliness might open opportunities for sustainable entrepreneurs. Our study complements the

existing economic, institutional, and psychological perspectives and thus contributes to "a more diverse body of theory-based studies" in sustainable entrepreneurship (Shepherd and Patzelt 2011, p. 138). Our study also offers a theoretical model and direct empirical support for the intuition that "growing desire of market agents for cessation of environmentally degrading activities represents entrepreneurial opportunities" (Dean and McMullen 2007, p. 53).

## 2 Theory

### 2.1 Increasing dimensionality: when do new entrepreneurial populations emerge?

Multi-dimensional space is a well-understood concept in the toolkit of the social sciences, which has been widely applied to model social entities, such as product attribute space in consumer research (Lancaster 1966), organizational resource space in organizational ecology (Carroll et al. 2002; Hannan and Freeman 1989), manifesto topic space in democratic election theory (Lowery et al. 2010, 2013), music feature space (Van Venrooij 2015; Askin and Mauskapf 2017), social identity space of entrepreneurs (Lee and Venkataraman 2006; Sieger et al. 2016), and conceptual and semantic space of social concepts (Gärdenfors 2004, 2014; Hannan et al. 2019). The notion of multi-dimensional space has proved to be a useful modeling tool for social entities because how we perceive the world and how our minds organize information share many parallels with the characteristics of geometric space (e.g., Shepard 1987; Gärdenfors 2004, 2014; Hannan et al. 2019).

Following this long line of research, our model conceptualizes a market as a multi-dimensional space in which each dimension reflects a feature (or an attribute) considered as relevant by the essential resource holders when evaluating offerings in the focal market. As a result, each feature dimension represents a critical aspect of social demand from the resource holders' perspective (Ruef 2000). Over time, the feature dimensions in a market space may change as the features considered as relevant by critical resource holders evolve. For example, the relevant feature dimensions in the US beer market have increased over time as beer drinkers not only paid attention to taste and price but also increasingly cared about

authenticity (Carroll and Swaminathan 2000). Similarly, whether coffee is fairly traded or food is organically produced have emerged as relevant feature dimensions in their respective market spaces.

However, to date, the concept of multi-dimensional space is underutilized as a theoretical workhorse in the study of entrepreneurial population emergence. The only exception we know of is Ruef (2000), mapping the relevant identity attributes of the US health care sector in a multi-dimensional identity space. The emergence of new populations is explained by the positioning of their identities with respect to existing organizational populations in a given identity space. In contrast, we focus on the very structure of the multi-dimensional market space. More specifically, we theorize how the number of relevant dimensions defining the market space does change (Garcia-Diaz et al. 2013; Péli and Nooteboom 1999) and how such changes may trigger the emergence of new entrepreneurial populations.

Below, we explain in detail the theoretical mechanisms linking feature dimensionality change to entrepreneurial population emergence, as visualized in Fig. 1. A "+" sign means that the two variables linked by the arrow move in the same direction (i.e., if A increases, B increases too).

Market space dimensionality may change as a result of evolving discourse. Markets are social constructions whose existence and structure depend on the meaning agreed upon by market participants (Navis and Glynn 2010; Rosa et al. 1999). How many and which feature dimensions are relevant for a market category are a matter of what market participants collectively take for granted (Hannan et al. 2007) at present time (and location). As a result, such beliefs may evolve as the underlying socio-cognitive consensus changes. A principal device of social construction and sensemaking is *discourse* (Kennedy 2008; Khaire and Wadhwani 2010; Rao et al. 2003; Weick 1995; White 2008). Professional or public discourses direct attention to new market categories (Schultz et al. 2014), new products (Rosa et al. 1999), and new attributes (Ruef 2000). Existing studies have argued that discourse shapes markets in a number of important ways, such as to help audiences to sort out the meaning of emerging product categories (Rosa et al. 1999), to grant cognitive and socio-political legitimacy to novel market segments (Schultz et al. 2014), to assist producers to locate and monitor their rivals, and to create awareness of emerging entrepreneurial populations (Kennedy 2008).
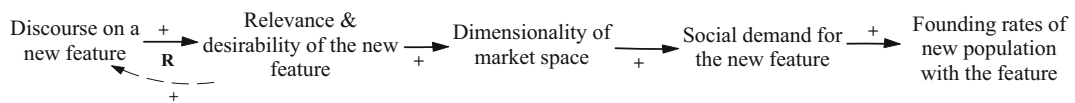
**Fig. 1** Feature dimensions and emergence of an entrepreneurial population

Two issues are critical here. One is *relevance*: i.e., whether a feature is worthy of attention. The other is *desirability*: i.e., whether a feature is considered to be desirable or whether relevant resource holders confer positive valence to the focal feature. Social demand depends on both relevance and desirability (Ruef 2000). As discourse starts to focus on a feature previously not seen as relevant to the focal market, attention of market participants for the new feature increases, boosting the perceived relevance of this feature. For instance, discourse about social problems generates public attention and creates cognitive space for arguments about possible solutions, often in form of a desirable new feature (Ruef 2000). Specialized gatekeepers, such as the general or professional media, select and broadcast messages resonating public sentiment (Greve et al. 2006; Rao et al. 2003), thus stimulating further discourse about better ways of doing things (Fiol and Romanelli 2012), so justifying the desirability of the new feature (Ruef 2000).

As a result, the new feature increasingly becomes taken-for-granted. Like a novel practice, as the new feature gains the standing of a taken-for-granted element in a social structure, it achieves socio-cognitive (or constitutive) legitimacy (Berger and Luckmann 1966; Carroll and Hannan 2000; Hannan et al. 2007; Meyer and Rowan 1977). Socio-cognitive legitimacy provides the fundament upon which normative and regulative legitimacy are constructed and is thus basic to the operations of social systems, including markets (Ruef et al. 1998). Note that increasing relevance and desirability of a feature may, in turn, sparkle further discourse on this feature, thus constituting a reinforcing feedback loop. We express such a loop as the dotted arrow and the letter "R" in Fig. 1. We believe that such a self-reinforcing mechanism is essential for an accelerating process of legitimizing the new feature.

As a new feature becomes taken-for-granted in the mindset of the market participants, the *dimensionality* of market space expands with this feature's dimension. That is, customer tastes become more complex. Based on the well-known mathematical problem of sphere-packing, Péli and Nooteboom (1999) provided a theoretical explanation for resource partitioning (Carroll 1985), demonstrating how and why specialist firms may flourish in a market dominated by generalists. They analyzed a multi-dimensional space packed with geometric objects of equal size (representing generalists), theoretically arguing that the residual space left empty (i.e., potential niche for specialists) between the objects steadily increases with rising number of dimensions of a multi-dimensional space. For example, the empty space between densely packed cannonballs of equal size in a three-dimensional space is larger than that between circles of the same size in a two-dimensional space. In a multi-dimensional market space, a dimension represents a feature and the residual space reflects unsatisfied demand. Hence, if the number of market dimensions increases due to new features becoming taken-for-granted, unsatisfied *social demand* grows.

Unsatisfied demand mostly arises in the vacant space along the new dimension. Such demand is not predesignated to be occupied by a particular organizational population, but for any populations offering the matching identity attributes (Ruef 2000). Through this theoretical lens, organizations are considered as bundles of features, with social demand for organizations depending on how the features are embodied in different (existing or *potential*) organizational populations. Hence, the question of whether a new entrepreneurial population can claim the vacant space by satisfying the untapped demand depends on whether the newcomers are seen as having a higher value of the new feature dimension than incumbents in existing populations and under which conditions this is the case.

Imprinting theory (Stinchcombe 1965), as known within the entrepreneurship community (e.g., Bamford et al. 2000; Milanov and Fernhaber 2009), provides an argument in favor of a new entrepreneurial population. So far, entrepreneurship scholars have concentrated on how early conditions at entry and decisions of new ventures have a lasting impact on future outcomes (Mathias et al. 2015). Much less explored is the "fit-by-birth" argument, which directly addresses the question of new feature dimensions being embodied in entrepreneurial populations. According to Stinchcombe (1965), socio-economic structures have maximal impact on new organizations because, in order to achieve

successful founding, entrepreneurs must first submit their organizational design for approval to key resource holders (e.g., investors), who evaluate the new offer against the backdrop of contemporary preferences and norms about what features organizations should have. Because the environment and social demand considered by these key resource holders mutate over time, the conditions imposed on potential organizations are regularly updated. The kind of organizations that pass such tests, and hence get founded, are thus imprinted with the social preferences of the founding period. For our model, this implies that incumbent populations possess those features that were considered as desirable when they were founded, while new venture populations are more likely to embody the features favored by contemporary social norms.

Of course, neither the rise of a new feature dimension nor the new venture population being imprinted with the new feature guarantees the emergence of a new entrepreneurial population. After all, new feature dimensions appear constantly across industries, but they do not always result in new entrepreneurial populations. Similarly, the innovation landscape is littered with "would-be" entrepreneurial populations that never quite emerged (McKendrick et al. 2003). What are the scope conditions under which our dimensionality model does apply in the sense of boosting newcomer emergence? We believe that two conditions are essential: (1) diseconomies of scope for incumbents and (2) demand reaching a minimum threshold.

First, we argue that incumbent populations must face diseconomies of scope, of whatever kind, in integrating the new feature dimension. If incumbent populations can easily expand into the new dimension and fully satisfy the new demand, then there are hardly any entrepreneurial opportunities, with little—if any—space for new populations. Take the example of the smartphone market. New demand for innovative features, such as e-wallet and health monitoring, emerges frequently, implying that dimensionality in this market multiplies quickly, especially during the industry growth phase. However, this does not mean that each additional new feature will result in a new population of smartphone producers. This is because the incumbent producers can relatively cheaply and quickly add these new features to their portfolio. In contrast, traditional wristwatch producers have great diseconomies of scope in adding new features, such as health monitoring and game-playing, because the required technologies and capabilities are distant from those for producing conventional watches. As a result, a sizeable new population of smartwatch producers emerged to satisfy the new demand.

Incumbents' diseconomies of scope may be of non-technological nature, rather being based on organizational identities. Similar to distant technological features, if the desired new feature has a character oppositional to the extant identities of the incumbents (Hannan et al. 2007, p.227), incumbents are more likely to fail to integrate this new feature. New venture populations can thus more easily gain a foothold in the market as a result of what may be referred to as the incumbents' "reputational" scope diseconomies. For example, craft breweries emerged as a sizeable new population and revolutionized the U.S. brewery market, not because the mass breweries cannot reproduce the technical features (such as taste and color) of craft beers, but because their corporate character (and large size) is considered orthogonal to an authentic craft beer producer (Carroll and Swaminathan 2000).

The second condition is related to carrying capacity. We contend that demand for the new feature needs to reach a minimum threshold for an entrepreneurial population to emerge and settle in. Due to heterogeneous consumer tastes, potentially there exist an infinite number of new features with latent social demand. However, the majority of these latent feature dimensions never manage to turn into realized niches for new entrepreneurial populations. An important condition for new entrepreneurial population success is density. According to density dependence theory (Hannan and Freeman 1989), reaching a minimum threshold of organizational density is important for a group of entrepreneurs pursuing novel activities to be recognized as a new population. Sufficient organizational density is possible only if the latent social demand, or carrying capacity, for a new feature reaches a minimum threshold. If the demand for obscure new features can accommodate only a few organizations, the chances are slim that they will ever reach the organizational density necessary for establishing a new population. Of course, what constitutes the minimum threshold of intrinsic social demand varies greatly across features and industries.

We summarize our argument in Fig. 1. With (a) collective sensemaking through public discourse, (b) rising new feature dimension, and (c) under the two scope conditions, new entrepreneurial populations in form of new founding waves may emerge to satisfy

unfulfilled demand by occupying the vacant feature dimension's space. Then, we expect entrepreneurial opportunities to open across market locations, implying that *founding rates* experience a general rise.

> Hypothesis 1 (H1) Rising discourse on a new feature positively affects founding rates of organizations with the feature across market locations.

## 2.2 Local demand: where do new entrepreneurial populations emerge?

Above, we argued that a novel feature dimension may well trigger social demand for an entirely new organizational population, resulting in generally expanding entrepreneurial opportunities across market locations. Next, we ask *which* market locations offer entrepreneurs better opportunities. We reason that geographic communities with higher local social demand for the new feature provide a more favorable founding environment for ventures embodying the focal feature. This is because potential entrepreneurs embedded in such communities (1) are better positioned to form entrepreneurial opportunity beliefs related to the new feature and (2) can find more sympathetic reception and more support when assembling the necessary resources. As a result, we expect higher founding rates in communities more appreciative of the new feature (i.e., with higher local social demand).

Our underlying assumption is that individual entrepreneurs do not form their ideas in a social vacuum—quite the contrary. The processes of forming opportunity beliefs and mobilizing resources are actively shaped by their social context, such as their local communities, which not only regulates information flow and resource access but also imposes social norms for interpreting and acting (Dahl and Sorenson 2012; Dimov 2007; Zahra et al. 2014). Figure 2 illustrates the theoretical model. In what follows, we present detailed explanations for each part of the model.

The stage preceding any entrepreneurial action is forming *entrepreneurial opportunity beliefs*. This process depends on: (1) the stock of domain-specific knowledge so that the individuals can recognize opportunities (McMullen and Shepherd 2006; Shepherd and Patzelt 2011) and (2) the perceived feasibility and desirability of the recognized opportunities (Krueger 1993; McMullen and Shepherd 2006). Thus, for social environments like geographic communities to encourage entrepreneurial action, they need to provide a favorable context for forming entrepreneurial opportunity beliefs. We argue that individuals embedded in communities sympathetic toward the new feature are more likely to form entrepreneurial opportunity beliefs along the new feature dimension because they are more likely (1) to accumulate domain-specific knowledge related to the focal feature and (2) to perceive greater feasibility and desirability of starting a venture embodying the new feature.

First, whether or not a potential entrepreneur can recognize opportunities in a local area depends on whether or not s/he knows enough about the focal domain. Without a certain level of domain-specific *knowledge*, s/he would be blind for trends and opportunities, failing to identify latent demand (McMullen and Shepherd 2006). We assert that individuals embedded in communities sympathetic toward the new feature are more likely to recognize entrepreneurial opportunities because they are more likely to perceive the new feature aligned with their personal value. As a result, they are more motivated to allocate greater attention to the issue, thus developing greater awareness and more domain-specific knowledge (McMullen and Shepherd 2006).

Second, social interactions are more likely to relate favorably to the new feature because of other residents' greater appreciation (Dahl and Sorenson 2012). This further strengthens the domain-specific knowledge of the potential entrepreneurs. For example, potential entrepreneurs might learn that there indeed is concrete and substantial demand for products or services embodying the new feature. Additionally, in a receptive community, they are more likely to know potential investors and target customers. As a result, they are more likely to evaluate the *feasibility* of acting entrepreneurially along the new feature dimension as high.

Third, acting entrepreneurially in relation to the new feature is more likely to be perceived as desirable in communities conducive to the feature. Social norms and public opinions not only guide the potential entrepreneurs to embrace opportunities but also increase the perceived normative legitimacy and social *desirability* of such actions (Meek et al. 2010; York and Lenox 2014). For example, Greve et al. (2006) found that there are more founding attempts in communities with a public discourse that favored low-power FM radio, because this then-new type of broadcasting was perceived as desirable by the local community.
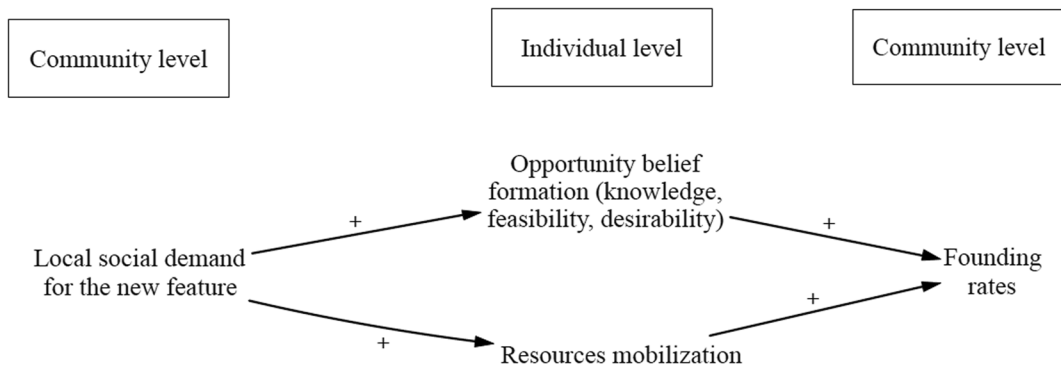
**Fig. 2** Local social demand, entrepreneurial action, and founding rates

Having formed opportunity beliefs and having decided to take actions, an entrepreneur faces the task of assembling the necessary financial, human, and physical resources (Katz and Gartner 1988; Reynolds and Miller 1992; Ruef 2005). Acquiring these resources is difficult for any start-up (Dahl and Sorenson 2012), but is especially challenging for entrepreneurs in an emerging population. The latter operate in a hostile environment and must convince "extremely sceptical customers, creditors, suppliers, and other resource holders and … build trust in a vacuum" (Aldrich and Fiol 1994, p. 650). We argue that in communities where residents appreciate the new feature (i.e., implying greater social demand), new ventures embodying the feature face less skepticism and receive more sympathetic reception. As a result, potential entrepreneurs in such communities are more likely to convince and recruit investors, like-minded co-founders, prospective employees, and key suppliers whose values are aligned with their vision or with the appropriate knowledge and expertise. They are thus more likely to successfully mobilize resources and complete the founding process.[1] In line with this, Boone and Özcan (2014) showed that US bioethanol cooperatives, as part of the anti-corporate movement, enjoyed greater founding success in communities with a stronger anti-corporate sentiment.
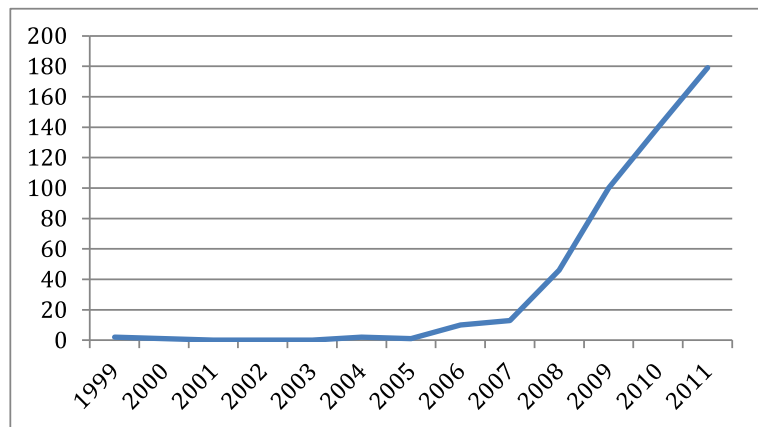
Hypothesis 2 (H2) As a community becomes more appreciative of a new feature, it will experience higher founding rates of organizations characterized by the new feature.

## 3 Empirical setting

We test our hypotheses in the German electricity market. Our objective is to explain the rapid emergence of a sustainable entrepreneurial population—that of the energy cooperatives (i.e., ECs). Figure 3 shows the EC founding rates in our observation period from 1999 to 2011. While only seven ECs were founded from 1999 to 2005, the number of EC foundings started to grow as of 2006, the pace further accelerating from 2008 onwards. For example, 42 ECs entered the market in 2008, and well over 100 ECs were founded in both 2010 and 2011.

What kind of organization is the EC? ECs typically engage with generation of mostly electricity (and a small percentage of heat) using exclusively renewable sources, such as solar, wind, and biomass. According to a survey of ECs, the most important organizational goals include renewable energy generation, contributions to climate change control and value creation in the local community (Volz 2012). Typically, a group of like-minded entrepreneurial citizens from the same local community start the founding process of an EC, initially because they worry about climate change and feel dissatisfied with the current high percentage of fossil and nuclear sources used in electricity generation. Often working voluntarily, these entrepreneurial citizens contribute their personal savings, recruit further members, and install green generation capacity, such as solar

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[1] Our model aligns very well with basic arguments of the imprinting theory (Stinchcombe 1965). While the imprinting theory focuses on the varying founding conditions in different time periods (i.e., socio-economic structures have maximal impact on organizations born in the contemporary period), we emphasize the heterogeneous founding conditions across geographic locations (i.e., the local socio-economic structures determine what kind of organizations get founded).

**Fig. 3** Number of German EC foundings (1999 to 2011)



panels, biomass boilers, and wind turbines (Bayerische Gemeindezeitung 2011; Die Tageszeitung 2010; Kölnische Rundschau 2011; Rheinische Post Duesseldorf 2009; Stuttgarter Zeitung 2008). The generated electricity is then fed into grid and generates revenues (Volz 2012). The EC represents a form of sustainable entrepreneurship, which is "focused on the preservation of nature, life support, and community in the pursuit of perceived opportunities to bring into existence future products, processes, and services for gain, where gain is broadly construed to include economic and non-economic gains to individuals, the economy, and society" (Shepherd and Patzelt 2011, p. 137).

The financial barrier of becoming an EC member is modest as the minimum membership contribution often starts from around 50 Euros (Rheinische Post Duesseldorf 2011). Sometimes, local citizens are so enthusiastic about the idea and eager to join that the ECs have to create waiting lists because the speed of creating suitable renewable energy projects cannot keep pace with the growth of membership contributions (Stuttgarter Nachrichten 2011). In spite of their small organizational size and recent emergence, ECs have become a formidable economic, political, and social force. Until 2014, ECs have attracted 130,000 members in Germany, invested over 1.67 billion Euros in green energy, and built 933-MW generation capacity using renewable sources (Energie und Management 2015). ECs are a striking example of a recently emerged and fast-growing sustainable entrepreneurial population, with greenness as its main identity feature.

How to explain the flourishing of ECs in the German electricity market? Our reading of the literature reveals that three accounts have been offered, which try to

explain the emergence of this sustainable entrepreneurial population from economic and/or institutional perspectives. Below, we argue that none of these offers a full explanation for the ECs' emergence. First, EC foundings have been associated with the *German Renewable Energy Law* in 2000, which gives economic incentives for producing renewable energy with guarantees for grid access and prices (Egloff 2012; Maron and Maron 2012; Nestle 2014). This cannot explain the burst in EC foundings for two reasons. For one, what is the explanation for the large time gap between the EEG law in 2000 and the EC founding wave starting around 2006? Moreover, multiple surveys on members of ECs show that the main incentives for citizens to found an EC are *not* economic ones (Reiner 2012; Volz 2012).

Second, the recent price drops of photovoltaic (PV) panels may be a potential explanation. However, while the PV panel prices have steadily decreased and then stabilized until 2003, they actually started to rise steeply from 2004 to 2008 (Mints 2013). This period of increasing prices coincides with the start of the EC founding wave, assuming a one to 2-year preparation period preceding founding. Besides, how to explain the entry of the considerable number of ECs using non-solar technologies, such as wind, water, and biomass?

Third, the *Amendment of the German Cooperatives Law* at the end of 2006 (Egloff 2012; Nestle 2014; Volz 2012) allows social-cultural organizations to use the cooperative form, making founding cooperatives much easier across all industries. Indeed, most ECs were founded after 2006. If the Cooperative Law Amendment would offer a full explanation, we should observe cooperative founding waves across all industries and especially in the social-cultural industries. To examine the

explanatory power of this account, we collected founding data of cooperatives across all 60 industry sectors in Germany from the German Trade Register (for more details, see the "Data and methods" section). As Fig. 4 shows, among the 99 cooperatives founded in 2006, only one was in the energy industry. In contrast, of the roughly 200 cooperatives founded in 2008, almost one quarter were in the energy industry, leaving three quarters to be spread across the other 59 industry sectors. Even more surprisingly, over 50% of the 347 cooperative foundings in 2011 were in the energy industry alone. Indeed, the Cooperatives Law Amendment encouraged cooperative foundings in general, but why especially in the electricity industry instead of more evenly spread across all industries? What happened in the electricity market that offered such extraordinary entrepreneurial opportunities?

Existing research on sustainable entrepreneurship has developed along three main lines (Shepherd and Patzelt 2011): economic (e.g., Cohen and Winn 2007; Dean and McMullen 2007; Mrkajic et al. 2017; Pacheco et al. 2010), institutional (e.g., Grinevich et al. 2017; Meek et al. 2010; Sine et al. 2007; Sunny and Shu 2017; York and Lenox 2014; York et al. 2016a), and psychological (e.g., Patzelt and Shepherd 2011; Muñoz and Dimov 2015; York et al. 2016b). In the case of ECs, the economic and institutional accounts cannot solve the complete puzzle, offering only a partial explanation for its rapid emergence, at best (see also the "Robustness checks" section). We argue that a socio-cognitive theoretical lens supplies the main pieces of the puzzle. Applying our theory to the EC case, we contend that ECs' emergence can be attributed to the recent rise of the socio-cognitive dimension of greenness (or environmental friendliness) in the German electricity market.

During the phase of EC emergence, public discourse on greenness in the electricity market has grown substantially. As Fig. 5 reveals, for a selected sample of three German daily newspapers for which complete time-series data are available (*Die Tageszeitung*, *Börsenzeitung*, and *Nürnburger Nachrichten*), the number of articles discussing greenness-related issues in the electricity market as their main topic increased rapidly from 1997 to 2011. While about 230 articles related greenness to electricity in 1997, approximately 670 articles did so in 2011. So, the volume of public discourse on greenness in the electricity market experienced a 200% growth in these three dailies. During the same period, social demand for green electricity rose considerably, according to a series of surveys conducted by BDEW—the German Association of Energy and Water Industries (BDEW 1999–2009). Renewable energy was still irrelevant for customers before 2001, with its prominence growing exponentially afterwards. In 2008, among the customers who switched suppliers, around one third did so to receive renewable energy. Wishing to have renewable energy became one of the top reasons for the switching decision. We argue that the rising public discourse on greenness feeds into increasing market space dimensionality and social demand in the German electricity market, which in turn triggered the emergence of the sustainable entrepreneurial population of ECs.

Fig. 4 Number of total cooperative foundings (in dotted line) versus EC foundings (in solid line) from 1999 to 2011
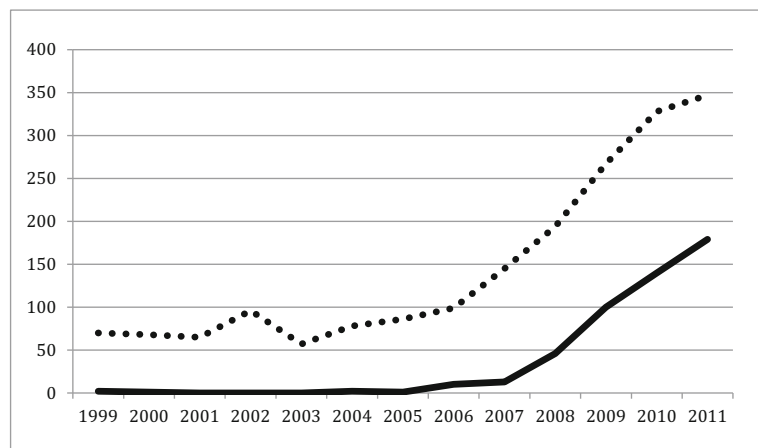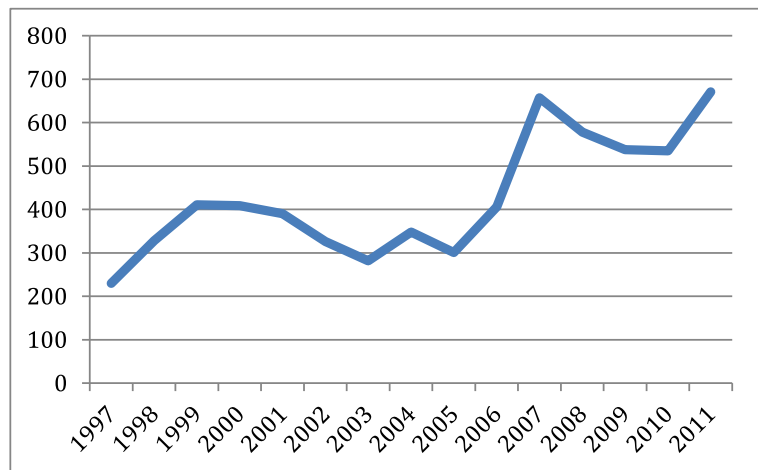
**Fig. 5** The rise of greenness dimension in the German electricity market (1997–2011)



## 4 Data and methods

### 4.1 Data

To test our hypotheses, we collected three sets of data. The first data set concerns the events of EC foundings in the period 1999–2011. The data were primarily obtained from the German Trade Register through the database Nexis, by searching for the German words for "cooperative" (*Genossenschaft*) and "new registrations" (*Neueintragungen*). Each new registration includes a list of information items such as the cooperative's name, address, time of registration, industry classification codes, and a short description of the organizational objectives and activities. We used the information on industry classification codes and organizational objectives/activities to determine whether a cooperative operates in the electricity industry and generates electricity using renewable sources.

To test H1, we collected a second data set of German newspaper articles for measuring public discourse on greenness in the electricity market from 1997 to 2009. First, as a starting point, we used the database Nexis and identified those German daily newspapers available throughout our observation period. A complete archive of the same set of newspapers during the observation period is necessary because our purpose is to observe changes in public discourse over time. For example, if we include not only newspapers archived from 1997 to 2009 but also those archived only from 2003, we might observe a spurious increase of articles discussing greenness as of 2003. Three newspapers turned out to have a complete archive during our observation period: a

national general newspaper (*Die Tageszeitung*), a national newspaper specializing in economic and market news (*Börsenzeitung*), and a local newspaper (*Nürnburger Nachrichten*). We believe that these three newspapers together give a representative picture of public discourse in Germany. *Die Tageszeitung* and *Börsenzeitung* are two large national dailies, and *Nürnburger Nachrichten* is a local newspaper of the region and city Nürnburg. Nürnburg is a representative region with socio-demographic characteristics, such as disposable income and environmental friendly attitudes that are similar to the mean values across all German counties. Adding a representative local daily to our pair of national newspapers thus helps to correct for a potential national bias.

Second, a combination of search terms was selected to identify articles on the subject of the electricity market in the archive of these three newspapers. This resulted in 13,346 articles. Finally, within the articles on the electricity market, we searched for those mentioning greenness-related keywords as the main topic. The newspaper archive of Nexis identifies at the bottom of each article several main features of an article, such as the main topic, the focal companies, and the relevant industries. Our search identified those articles with the greenness-related keywords in the main topic section. This final step produced 5204 articles, which were then used to construct the variable for greenness discourse.

To test H2, we gathered a third dataset regarding socio-demographic statistics of the 439 counties in Germany for the period from 1997 to 2009, as published by the German Federal Statistical Office. With these data, we can construct proxies for community-level social demand for greenness.

## 4.2 Variables

*Dependent variable* Our dependent variable is county-level EC founding. A total of 459 new ECs were founded during our observation period from 1999 to 2011 in the German electricity market. The dependent variable *founding* is coded as the number of ECs established in the focal county in a given year.

*Independent variables* To test H1, the prominence of the greenness discourse in Germany (*greenness discourse*) in a given year is coded as the total number of newspaper articles (in 100 units) on the electricity market with greenness as a main topic. To test H2, the extent to which the local communities appreciate greenness is measured at the county level. Existing research indicates that environmental friendly attitudes of Germans correspond to their voting behavior. Based on the "Environmental Consciousness and Behavior Survey" of the German Federal Environmental Agency, Witzke and Urfei (2001) found that people's willingness to pay for environmental protection is highly correlated with their voting for the German Green Party. We thus proxy the local preference for greenness (*local greenness*) with the proportion of people in a county voting for the German Green Party in the national *Bundestag* election. *Bundestag* elections are held every 4 years. Linear interpolation was used for the missing years (see also Liu and Wezel 2015).

*Control variables* According to density-dependence theory (Carroll and Hannan 2000), the relationship between density and the founding rate is expected to be non-monotonic. Therefore, we follow standard practice in organizational ecology and control for EC density and density squared (*EC density*, and *EC density²*) at the nation level. Existing research also indicates that entrepreneurial activities may be influenced by local economic demand, reflected in population density and income (e.g., Reynolds et al. 1994). Thus, we controlled for population per square kilometer (*population density*). One of the most important resources to start an EC is the sum of member contributions that the sustainable entrepreneurs can obtain, which is highly correlated with the local disposable income and savings. Hence, we also controlled for the average disposable income per person at the county level (*disposable income*). Extant research (e.g., Fritsch and Wyrwich 2014) indicates remarkable differences in entrepreneurial activities

between West and East Germany (the formal German Democratic Republic). This is not surprising since East Germany has been, for over four decades, under a socialist regime that more or less tried to extinguish entrepreneurship completely. Taking this difference into account, we controlled for whether a county is located in the former German Democratic Republic (*east*).

The independent variables were lagged for 2 years to avoid reverse causality and to acknowledge the substantial duration of the founding process of ECs. A 2-year founding process seems to be reasonable. Qualitative evidence of EC founding stories supports the assumption that about 2 years tend to pass from the initial idea to actual founding. In Emstal, for example, a municipality located in the State Hessen, the idea of an EC emerged in 2007. In March 2008, 19 key people participated in a meeting on this topic, organized by Volksbank Emstal Cooperatives and the Emstal Municipality. In 2009, Energiegenossenschaft Nahwärme Emstal eG was founded (Emstal eG 2015). Note that we also ran robustness analyses with a 1-year lag, and the results are similar (see the "Robustness checks" section). Table 1 presents the descriptive statistics and the bivariate correlations of the variables.

## 4.3 Model specification

Our dependent variable EC foundings is a count variable that takes on non-negative integer values following a Poisson distribution. The main problem to deal with is overdispersion—i.e., the tendency of the variance to increase faster than the mean. In the presence of overdispersion, parameter estimates are inefficient, although they remain unbiased, and their standard errors are biased downward (Long 1997). We use negative binomial regression models to correct for overdispersion. Another issue is unobserved heterogeneity, which may stem from unmeasured differences among observationally equivalent counties that affect the probability with which ECs are founded. Unobserved heterogeneity can lead to specification error (Heckman 1979). One way to treat unobserved heterogeneity is to use unconditional fixed effects models by including dummy variables for all individual counties (Allison and Waterman 2002). However, this method is unable to include time-invariant variables, as these will be dropped from the model (Allison 2009). In our setting, it is essential to include time-invariant predictors, such as whether a county is located in the formal

**Table 1** Summary statistics and bivariate correlation ($N = 5220$)

| Variable | Mean | SD | Min | Max | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| 1. Founding | 0.06 | 0.34 | 0 | 6 | 1 | | | | | | | |
| 2. Greenness discourse | 4 | 1.19 | 2.30 | 6.57 | 0.28 | 1 | | | | | | |
| 3. Local greenness | 7.17 | 3.39 | 1.87 | 28.68 | 0.18 | 0.26 | 1 | | | | | |
| 4. EC density | 84.92 | 41.75 | 62 | 216 | 0.33 | 0.60 | 0.29 | 1 | | | | |
| 5. EC density$^2$/1000 | 8.95 | 11.40 | 3.87 | 46.66 | 0.31 | 0.52 | 0.27 | 0.99 | 1 | | | |
| 6. Disposable income | 16.71 | 2.53 | 10.82 | 32.42 | 0.19 | 0.38 | 0.58 | 0.36 | 0.32 | 1 | | |
| 7. East | 0.27 | 0.44 | 0 | 1 | −0.08 | −0.05 | −0.46 | −0.05 | −0.04 | −0.54 | 1 | |
| 8. Population density | 0.50 | 0.65 | 0 | 7.18 | −0.03 | 0.01 | 0.43 | 0.01 | 0.01 | 0.17 | −0.15 | 1 |

German Democratic Republic (*east*). Another drawback of the unconditional fixed effects models is that the models are unlikely to converge when the number of individual dummies is too large, like in our case.

Instead, we use a hybrid method combining fixed and random effects to get some of the virtues of each, as proposed by Allison (2009)—an approach that has recently been introduced into the management literature (e.g., Grohsjean et al. 2016). It allows us to control for unobserved heterogeneity *and* to include important time-invariant variables. As a first step, we calculated the mean for each time-varying variable. We also calculated the deviation from those means for each time-varying variable. As a next step, we ran random effects negative binomial regression models with both the deviation variables and the mean variables as predictors. The time-invariant variables can be included as in normal random effects models. Finally, the coefficients for the deviation variables can be interpreted as fixed effects estimates because they are based only on within-community variation, therefore controlling for unobserved heterogeneity.

## 5 Results

### 5.1 Main findings

Table 2 reports the ML estimates of the hybrid negative binomial models of EC founding rates between 1999 and 2011, showing the deviation variables. Model 1 serves as the baseline, including only the control variables. The estimates of the effects of the control variables align with our expectations. Unsurprisingly, higher disposable income is linked to more EC foundings, indicating that it is easier to mobilize

financial resources and obtain membership contributions in more wealthy counties. In addition, an EC is much less likely to be founded in the former East-German counties, conforming the findings of Fritsch and Wyrwich (2014) on the persistent relative lack of entrepreneurship in the formal GDR regions. According to density-dependence theory (Carroll and Hannan

**Table 2** Effects on the founding rates of energy cooperatives, 1999–2011 (ML estimates of negative binomial models with hybrid method)

| | Model 1 | Model 2 | Model 3 |
|---|---|---|---|
| Greenness discourse | | 0.58*** | 0.54*** |
| | | (0.078) | (0.078) |
| Local greenness | | | 0.17** |
| | | | (0.082) |
| EC density | 0.078*** | 0.042*** | 0.033*** |
| | (0.010) | (0.011) | (0.012) |
| EC density$^2$ | −0.22*** | −0.10*** | −0.086** |
| | (0.032) | (0.036) | (0.036) |
| Disposable income | 0.36*** | 0.25*** | 0.25*** |
| | (0.086) | (0.084) | (0.082) |
| East | −1.11*** | −1.07*** | −0.70** |
| | (0.27) | (0.27) | (0.28) |
| Population density | 0.20 | 0.21 | 0.24 |
| | (0.26) | (0.25) | (0.26) |
| _cons | −1.31* | −1.69** | −1.90** |
| | (0.79) | (0.81) | (0.79) |
| N | 5220 | 5220 | 5220 |
| ll | −1072.3 | −1046.6 | −1034.0 |
| Chi$^2$ | 520.9 | 452.3 | 476.5 |

*$p < 0.1$

**$p < 0.05$

***$p < 0.01$

2000), the relationship between density and the founding rate should be non-monotonic. We expect a positive first-order estimate from the legitimation effect when EC density is still low and a negative second-order coefficient from the competition effect as EC density further increases. In line with our expectation, the effect of *national EC density* is positive, and significant and that of *national EC density*[2] negative and significant. In contrast to the deviation variables, the coefficients of the mean variables do not admit a causal interpretation in the hybrid models and thus are not included in the table (Allison 2009).

We introduce our H1-related variables in model 2. H1 predicts that increasing discourse on the new dimension of greenness would increase the dimensionality of the market space, subsequently leading to an overall increase of EC foundings across counties. The coefficient for *greenness discourse* is positive as expected and significant at the .01 level. For every additional 100 newspaper articles discussing greenness in the electricity market, the odds of EC founding rates at the county level increases by 1.72 (=exp(0.58)), or by 72% (=(1.72 − 1) ∗ 100). We thus conclude that our findings support H1. Model 3 adds the variable *local greenness* to test H2. In H2, we predicted that ECs are more likely to be founded in communities where local social demand for the sustainable entrepreneurial ECs is high because the local residents appreciate greenness. Aligning with our theory, if the percentage of people voting for the Green Party in a community were to increase by 1%, the odds of EC founding rates increases by 1.185 (=exp(0.17)), or by 18.5% (=(1.185 − 1) ∗ 100). Hence, H2 is supported, too.

## 5.2 Robustness checks

We ran several alternative models to ensure the robustness of our results. First, we used an alternative measure for *greenness discourse*, originally measured as the total number of newspaper articles discussing greenness in the electricity market in a given year. Since the total number of articles on electricity market (i.e., both related and unrelated to greenness) might vary from year to year, the absolute number of greenness articles might obscure the relative prominence of the greenness discourse. For example, in year 1, there are 100 articles on the electricity market. Among these, 50 articles discussed greenness. Hence, 50% of the articles on the electricity market in year 1 deal with the greenness topic. In year 2, there are 1000 articles on the electricity

market, of which 200 discuss greenness. So, in year 2, only 20% of the articles on electricity market actually deal with greenness topic, although the absolute count in year 2 is four times as large as in year 1. To ensure that this does not produce spurious results supportive of our theory, we use an alternative measure: *percentage greenness discourse*, which is the number of articles discussing greenness in the electricity market divided by the total number of articles on the electricity market in a given year. The obtained results, which can be seen in Table 3, resemble those reported in Table 2.

Second, we used the method of generalized estimation equations (the XTGEE routine in Stata 14), and we modeled the dependent variable using the following specifications: complementary log-log and logit. For these models, the dependent variable is coded as 1 when at least one EC is founded in the focal county in a given year and 0 otherwise. The findings of the logit models

**Table 3** Robustness check: alternative measure of greenness discourse (ML estimate of negative binomial models with hybrid method)

|  | Model 1 | Model 2 | Model 3 |
|---|---|---|---|
| % greenness discourse |  | 0.085*** | 0.075*** |
|  |  | (0.021) | (0.021) |
| Local greenness |  |  | 0.21** |
|  |  |  | (0.082) |
| EC density | 0.078*** | 0.059*** | 0.049*** |
|  | (0.010) | (0.011) | (0.011) |
| EC density$^2$ | − 0.22*** | − 0.19*** | − 0.16*** |
|  | (0.032) | (0.033) | (0.033) |
| Disposable income | 0.36*** | 0.30*** | 0.29*** |
|  | (0.086) | (0.087) | (0.083) |
| East | − 1.11*** | − 1.09*** | − 0.70** |
|  | (0.27) | (0.27) | (0.27) |
| Population density | 0.20 | 0.20 | 0.24 |
|  | (0.26) | (0.26) | (0.26) |
| _cons | − 1.31* | − 1.59** | − 1.81** |
|  | (0.79) | (0.80) | (0.78) |
| N | 5220 | 5220 | 5220 |
| ll | − 1072.3 | − 1063.6 | − 1050.1 |
| Chi$^2$ | 520.9 | 484.9 | 510.5 |

Standard errors in parenthesis

*$p < 0.1$

**$p < 0.05$

***$p < 0.01$

**Table 4** Robustness check GEE estimates of negative binomial models with hybrid method

|  | Model 1 | Model 2 | Model 3 |
|---|---|---|---|
| Greenness discourse |  | 0.56*** | 0.52*** |
|  |  | (0.086) | (0.087) |
| Local greenness |  |  | 0.22** |
|  |  |  | (0.099) |
| EC density | 0.078*** | 0.040*** | 0.031*** |
|  | (0.012) | (0.013) | (0.031) |
| EC density$^2$ | − 0.23*** | − 0.10** | − 0.081* |
|  | (0.038) | (0.041) | (0.042) |
| Disposable income | 0.48*** | 0.35*** | 0.34*** |
|  | (0.11) | (0.10) | (0.099) |
| East | − 1.12*** | − 1.08*** | − 0.68** |
|  | (0.28) | (0.28) | (0.29) |
| Population density | 0.27** | 0.28** | 0.32** |
|  | (0.13) | (0.15) | (0.14) |
| _cons | − 3.26*** | − 3.66*** | − 3.75*** |
|  | (0.79) | (0.80) | (0.78) |
| N | 5220 | 5220 | 5220 |
| Chi$^2$ | 600.9 | 525.1 | 507.1 |

Standard errors in parenthesis

*$p < 0.1$

**$p < 0.05$

***$p < 0.01$

are reported in Table 4. Again, the results are very similar to those in Table 2.

Third, we tested the robustness of our results by controlling for alternative explanations based on institutional and legal changes, as discussed above. We created a dummy variable for the period from 2000 to 2006 to account for the effect of the *German Renewable Energy Law* introduced in 2000. We constructed a second dummy variable for the period after 2006 to account for the institutional changes brought about by the *Amendment of the German Cooperatives Law*. A dummy for the period before 2000 was used as the reference category. The results after controlling for both institutional changes are similar to those in Table 2 (results available upon request). This adds additional evidence that an institutional account does not offer a full explanation for the emergence of the sustainable German EC population. We also wanted to control for the price changes of the PV panels. This turned out not to be feasible because of the high negative correlation between the PV panel price trend and *greenness discourse*—our independent variable for H1.

The prices for PV panels happened to drop when the German public engaged in increasing discourse on greenness as a new feature dimension for the electricity market. However, we are confident that price change of PV panels does not offer a full explanation due to the large number of EC foundings using other, non-solar technologies, such as biomass, wind, and hydropower.

Fourth, we re-ran our models with 1-year rather than 2-year lag, because the time needed to complete the founding process might vary across periods and locations. Our considerations are the following. The length of time for resource mobilization might be longer during the early phase of population emergence and shorter in the later period when the legitimacy for this novel type of entrepreneurial activities is fully established. The founding period might also be shorter in regions with a considerable number of existing ECs, where the infrastructures are more established and the entrepreneurs can quickly assemble the building blocks of a new EC. Again, the produced pattern of results is similar to what we report here (results available upon request).

Finally, we re-estimated the models after controlling for the types of local incumbent energy suppliers and obtained similar results (available upon request). This implies that, apparently, the social demand for the new feature dimension greenness was and/or could not be totally satisfied by incumbent populations, adding further support for our dimensionality argument.

## 6 Discussion and conclusion

The present paper focuses on the innovator type of entrepreneurship: i.e., those entrepreneurs pursuing innovative activities with few precedents. We explain population emergence as a result of growing social demand associated with new feature dimensions. Our feature dimensionality approach offers an appropriate theoretical tool to address the questions related to entrepreneurial population emergence because: (1) the demand created by changing socio-cognitive dimensionality is directly linked to the latent carrying capacity for entrepreneurial activities, which predates the emergence of new entrepreneurial populations and (2) its suitability for modeling qualitative environmental change makes it the perfect device to study the conditions under which new entrepreneurial populations are favored over incumbents by selection (Le Mens et al. 2015; Péli 2009; Péli and Bruggeman 2007).

We conceptualize a market as a multi-dimensional feature space in which each dimension constitutes latent social demand from resource holders. As the relevance and desirability of a new feature do increase, the number of market space dimensions does grow. The vacant space along the new feature dimension represents unfulfilled social demand, calling for offerings from organizations whose attributes better match the new dimension. New venture populations are more likely than incumbents to embody the features favored by contemporary social norms as reflected in the new feature dimension. As a result, a new entrepreneurial populations characterized by the focal feature emerges to occupy the space associated with the vacant feature dimension. They do so only when the scope conditions of (1) diseconomies of scope for incumbents and (2) demand reaching a minimum threshold are satisfied. We tested our theory on the emergence of a sustainable entrepreneurial population—the German energy cooperatives population. We demonstrated how the rise of the socio-cognitive dimension of greenness created novel social demand and opened opportunities for a sustainable entrepreneurial population. In addition, we showed that ECs are more likely to be founded in communities where the local social demand for greenness is higher.

This study contributes to research on entrepreneurial population emergence and sustainable entrepreneurship. First, our demand-side model offers novel insights as to when and where new entrepreneurial populations do emerge. Our conceptualization of the market as a multi-dimensional space ties socio-cognitive shifts to changing social demand, providing a new way of thinking about carrying capacity, entrepreneurial opportunities and the timing of new population emergence. Second, we show that social demand from critical resource holders is distributed unevenly across market locations (e.g., regions), implying heterogeneous conditions for entrepreneurial activities. This, in turn, informs us where new types of entrepreneurship are more likely to emerge and flourish. Third, our socio-cognitive lens adds to the existing economic, institutional and psychological perspectives on sustainable entrepreneurship. In addition, our paper specifies the theoretical mechanism and delivers the empirical support for the long held intuition among entrepreneurship scholars that "growing desire of market agents for cessation of environmentally degrading activities represents entrepreneurial opportunities" (Dean and McMullen 2007, p. 53).

We believe the feature dimensionality approach opens up exciting venues for future research. The current paper, within its focus on new population emergence following increasing dimensionality, provides a general argument based on the imprinting theory that new entrants are more likely than the incumbents to embody the new features, under the scope conditions. However, contrary examples also abound that some incumbents do manage to integrate the new feature and capture the new demand with success. Here, we provide some preliminary reflections on this puzzle and offer suggestions for future research.

One scope condition of our model is that incumbents must face diseconomies of scope in integrating the new feature dimension. But such diseconomies of scope may be graded instead of categorical. That is, diseconomies of scope in integrating a new feature dimension may vary across different types of incumbents. Incumbents, whose existing features are distant from the new feature, face greater diseconomies of scope and are more likely to fail in capturing the new demand. For example, incumbents with identity features oppositional to the new dimension presumably face the greatest diseconomies of scope. On the other hand, incumbents whose existing features are more adjacent to the new feature, face less diseconomies of scope, and are more likely to successfully seize the new demand. This implies that the same environmental change might have heterogeneous impact on incumbents, depending on their extant features. In addition, the extent to which incumbents may capture the new demand also depends on carrying capacity. It is possible that part of the residual space is left open for incumbents (with limited diseconomies of scope), if the carrying capacity related to the new dimension is greater than the space being claimed by the new population. In other words, the fact that some incumbents succeed in capturing (part of) the new demand does not necessarily conflict with our dimensionality model of new population emergence. Future research could address these important questions concerning incumbent-newcomer dynamics by invoking different theoretical arguments (e.g., inertia) and collecting new data (e.g., more detailed information on incumbent characteristics). The current paper addresses only the effects of increasing dimensionality. Future research could also ask what happens if the number of feature dimensions decreases? How does shrinking dimensionality affect entrepreneurial activities and the nature of incumbent-newcomer dynamics? These questions have been largely overlooked, but nevertheless are of great importance for entrepreneurship research.

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