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Market Formation: Examining the Coordination of Heterogeneous Contributions

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Abstract

In this paper we analyze early stage market formation - the constitution and alignment of distinct market arrangements - as a problem of collective action. We examine how the structure of and variation in actors' roles and resource contributions, through interaction with their form of coordination (collaboration- or non-collaboration-based) affect the existence and extent of market formation thresholds. Besides including factors examined in traditional collective action research, returns-to-scale and initial resource endowments, we allow resource contributions to be imperfectly substitutable. Doing this is particularly relevant in market settings where actors easily take on entirely distinct roles. We examine market formation dynamics through a computational model, mapped onto empirical realities, in which actors adjust their commitments over time, examining their own as well as others' contributions, the latter with limited information. From the insights garnered we develop a set of propositions and an accompanying grounded typology of ideal-typical instances of market formation that serves as a parsimonious means to classify a range of market formation dynamics and the role and nature of collective action needed for successful market formation. Specifically, we find that

market emergence thresholds tend to be lower for markets involving high variation in growth strategies, though this effect is strongly suppressed under conditions of low substitutability. Most important, our analyses point to a market emergence conundrum: market success depends mostly on collaborative forms of coordination precisely where the basis for its existence is lowest. We discuss implications of taking this broader theoretical approach to market emergence.

Market Formation: Examining the Coordination of Heterogeneous Contributions

Introduction

Over the past decade, organization and entrepreneurship scholars have advanced theories regarding creation of new organizational forms, markets, and industries (Aldrich and Fiol, 1994; Rao, Morrill and Zald, 2000; Hargrave and Van de Ven, 2006) and have empirically sought to identify the mechanisms and processes associated with their origins and trajectories (Van de Ven and Garud, 1993; Lounsbury, Ventresca, and Hirsch, 2003; Rao, 2004; Haveman, Rao, and Paruchuri, 2007; Schneiberg, King, and Smith, 2008; Sine and Lee, 2009; Hiatt, Sine and Tolbert, 2009). Much of this work is grounded in the premise that collective action is central to the successful formation of new markets and industries. Recognizing the need to gain legitimacy and given the collective and purposive nature to achieve joint interests in market formation (Aldrich and Fiol 1994), some have proposed such behavior resembles that of social movements (Davis and McAdam 2000; Rao et al., 2000; Fligstein, 2001). Yet, while it is understood that these processes require collective action, the literature on new market formation tends to take for granted the existence of a shared collective rationale for action, leaving under analyzed the question of how markets succeed or fail to form.

By contrast, a stream of sociological literature has developed in parallel that provides important rationales as to why collective action may be difficult despite common (but not necessarily shared) interest (Granovetter 1978; Heckathorn, 1996; Marwell and Oliver, 1985; Gould 1993). Highlighting the importance of interdependent individual actors pursuing a common cause, these studies challenge the assumption that a shared interest necessarily equates to successful mobilization of resources and identifies the impediments to collective action and the mechanisms employed to overcome them. In particular, startup problems exist when interdependent but self-directed actors produce sufficiently strong positive externalities on each other, with each benefitting from others' commitment to a common cause (Heckathorn 1996). On the other hand, by demonstrating that under heterogeneous preferences collective action may form as participating actors

sequentially reduce others' impediments to action, this stream points to how actors can collectively influence the propensity to engage and the timing of that engagement in collective action (Oliver et al. 1985).

Despite these insights, this literature makes a number of assumptions that limit the generalizability and relevance of such an approach to market formation processes. First and foremost, these formal models assume that actor contributions to a collective effort are fully interchangeable. While this assumption may be reasonable in collective action contexts such as riot behavior, strikes, and the diffusion of innovations and rumors (Granovetter, 1978), it is less appropriate for settings such as new markets where market actors tend to play more specialized roles.

Taken together, the complementary contributions and gaps from the literatures on market formation and formal collective action models suggest significant theoretical advance for clarifying the role of collective action under different types of market formation dynamics. Specifically, we seek to extend theory and understanding regarding: i) the conditions for, existence of, and extent of market formation thresholds, and ii) the form of coordination and its degree of fragility between actors as they seek to align distinct contributions necessary for market formation. We do this through the development and analysis of a computational model that builds on, but alters foundational assumptions of the collective action literature. Specifically, we highlight the fundamental difference between collective action dynamics associated with perfectly and imperfectly substitutable contributions.

The general implication of the insights garnered from our computational analysis is an understanding of when similar mechanisms and processes associated with market formation may lead to entirely different outcomes, conditional on the form of interdependency and coordination between actors. From the analysis, we develop a set of propositions and an accompanying typology of ideal-typical instances of market formation that serves as a parsimonious means to classify a broad range of market formation dynamics and the role and nature of collective action needed for successful market formation. We propose this has significant merits given that few efforts have been made to categorize specific types of markets and then identify particular dynamics associated with their successful emergence or failure (Rao et al. 2000, Fligstein 2001 p14). Doing this provides

theoretical value for multiple reasons. First, such a typology, when grounded, helps identify important commonalities between seemingly idiosyncratic accounts of market emergence involving “strong speciation”, “new industries”, or “radical” innovations as it relates to market formation (Rao et al. 2000; Aldrich and Fiol 1994). Likewise, it can identify seemingly inconsistent outcomes between what seem comparable cases as resulting from either degeneracy or from its probabilistic nature. Further, such a typology may reveal the extent of sample selection bias involved as empirical research centers on industries that survived long enough to generate sufficient data for analysis (Aldrich and Fiol, 1994: 665), and with that, improve precision on our understanding of fundamental mechanisms of market formation success. Finally, a theory of market formation that accommodates multiple new market forms, including both strong and weak speciation, helps commensurate empirical and theoretical work by identifying common processes at work, where we may tend to correlate different types of markets with a distinct set of processes. While we focus on the context of market formation, our findings extend to a wide range of collective action settings in which contributions are imperfectly substitutable.

In the next section, we distil key conceptual elements and assumptions from the literature on market formation and collective action that underlie our formal model. Following this, we provide the basic structure of the model and then report the results from our computational analysis. We develop a typology of market formation that is grounded in propositions developed through computational analysis. We conclude with a discussion of the implications of this model and areas of future research.

Collective Action and Market Formation

While markets can be seen simply as locations where buyers meet sellers, others have recognized the importance of a market infrastructure, the social and material structure (such as standards, legitimation, knowledgeable workforce, codes, product categories, or regulations) that enables ongoing transactions between repeated market actors (Swedberg, 1994; Fligstein, 2001; White, 1981). Fligstein defines markets as “social arenas that exist for the production and sale of some good or service, and they are characterized by structured exchange” (2001: 30). Through structured exchange some set of rules, norms, or social structure must exist to

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guide and organize these exchanges requiring ongoing investment. It is through the establishment of such conditions that a stable market can emerge—a situation of “self-reproducing role structures,” wherein legitimacy for the product is established among buyers, a status hierarchy emerges within sellers, and the sellers are relatively stable and established on a period-to-period basis (White, 1981).

Based on conceptual foundations from White and Fligstein, we define markets as structured and patterned exchanges that exhibit a high degree of regularity in terms of product/service offering, actor roles played in the exchange, and the institutions (be it cognitive, normative, or regulative or a mix) that govern the exchange. This definition is flexible enough to include infrequent or arms-length exchanges, but generally implies that the development of a market requires investment from interested actors.

Taking this approach, we propose that most markets require investment in market infrastructure that is accurately conceptualized as a semi-public or collective good: investments by individual market participants in a market infrastructure enhance one’s own value of performing exchanges, while at the same time contributing to the market in the aggregate, albeit not necessarily to the same extent. By extension, while a single (or a few) market actor may occasionally seek to create a market, it is more likely that multiple actors, working in concert, are engaged in this process. Such a view is consistent with and builds on the recent rapprochement of organization theory and social movement theory to understand the origin of new organizational forms (Rao et al. 2000). This development has afforded scholars to make greater use of the conceptual machinery of social movement theory—framing processes, resource mobilization, and the exploitation of political opportunity structures (McAdam et al., 1996)—to explain industry emergence and change. However, despite multiple actors having a strong interest in the formation of a particular market, the development of its requisite market infrastructure may fail to materialize (Fligstein 2001; Rao and Giorgi 2006; Sine Haveman and Tolbert, 2005). So far, we have limited understanding as to why.

Our purpose is to analyze the central factors that generate this variety of outcomes in market formation. In doing this, we focus on the coordination challenges involved in the development of market infrastructure. We conceptualize market formation as a process that is inextricably bound up in resource

allocation, be it material (i.e., capital, labor, inputs) or more cultural, cognitive, or social resources such as managerial attention and sensegiving. To formalize the concept of market formation and to assess the degree to which particular factors impact successful formation, we explore the extent of market formation thresholds – the initial resources across distinct actors necessary to set in motion a self-fulfilling process of market formation. We focus on three explanatory factors that are central to collective action dilemmas, respectively returns-to-scale, interdependency, heterogeneity, and form of coordination, and modify them to make them relevant for market formation dynamics.

The first factor captures how the actual development of the market infrastructure relates to the mobilization of resources. The collective action literature demonstrates that differences in the returns from cumulative collective resources dedicated to a cause dramatically alter the existence, type, and extent of collective action dilemmas (Oliver et al. 1985). When returns-to-scale (hereafter designated as RtS) in resources are sufficiently strong, actors tend to face a startup problem: early commitment is costly, and, because of the uncertainty of the realization of the collective cause, committing resources early on is risky. However, after sufficient resources have been provided, other actors are increasingly willing to overcome their startup costs, resulting in the achievement of the collective cause. RtS are important not only because they affect one's interest to commit directly, but also have an indirect effect through influencing others' resource commitments. In market settings, the RtS that actors experience depend on the particular nature of a market formation problem. In the case of very new industries or radical technologies, market actors face high RtS because an institutional vacuum, difficulty attracting necessary resources, and an overall lack of legitimacy (Aldrich and Fiol 1994). In such situations, once these challenges are overcome, actors might extract large gains from their activities. However, early market infrastructure yields few benefits while actors incur high costs.¹ Yet, when critical factors (i.e., institutional support, distribution channels, cognitively recognizable product categories, and standards) already exist, RtS tend to be low (Rao et al. 2000). To formally define market-level RtS, we consider the relationship between resources provided and, first, the value derived from the resulting market

¹ This conceptualization of RtS is also consistent with those of technology adoption in which it plays a central role (Arthur 1989; Tushman and Rosenkopf 1992; Katz and Shapiro 1986)

² When taking the perspective of a single actor, throughout the paper we use the terms *ego* and *alii*. We use *alii* rather than *alter* to reflect

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infrastructure and, second, the costs incurred to do so.

The second factor relates to interdependency between actors within a market. An actor's contributions to a market infrastructure produce positive externalities as others also benefit from one's actions.

Understandings of collective action dilemmas rest on precisely this notion that actors' resource contributions are interdependent. In the archetypal collective action situation, an individual actor considers a one-off decision to participate in the cause based on their individual interest and the collective participation accumulated to the point of that decision (Marwell and Oliver 2000). By contrast, though, in market settings a broad set of actors each play an evolving role with their individual returns being a function of both collective and their own individual previous contributions to market infrastructure over-time. The relevant actors extend well beyond firms, as government, educational organizations, and the media create laws, regulations, and symbolic resources sustaining organizational communities (Aldrich and Ruef, 2006). Third, and perhaps most inconsistent with a market setting is the implicit assumption that each resource contribution can easily be interchanged with one another. That is, while in canonical models actors may differ in their interests, their resource contributions are considered to be perfectly substitutable.

Perfect substitutability of resource contributions is an appropriate assumption in many collective cause settings and is even defensible in some markets, such as the creation of a new market segment within a single population of producers that simply need to gain legitimacy for their new product or market category. However, its limitations are generally overlooked in the market formation context. For example, markets form often through alignment of field actors with distinct roles such that their contributions cannot be considered perfectly substitutable (Fligstein 2001).

Consider, for example, the development of community-supported agriculture in a metropolitan area. Assume that multiple self-determining actors each engage in a distinct component of this market: Farmers seek to develop the products, others promote overall health and sustainability benefits, some existing retailer owners contemplate freeing up space in their shops for this emerging category, etc... Thus, actors are interdependent, because their efforts to the market infrastructure improve the benefit of operating in the forming market. Importantly, however, actors provide distinct contributions to the formation of the market. For example,

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farmers cannot easily compensate through extra efforts when retail store owners do not offer them shelf space. That is, their contributions are imperfectly substitutable. This has large implications for the process of market formation. In contrast to when resource contributions are perfectly substitutable, absent any commitments by retail stores, distribution, consumer awareness, increasing commitments by a farmer will always increase her losses. Likewise, limited commitments by others may not help much. Only when the relevant market infrastructure is well developed, she is easily motivated to invest as well. More generally, in situations of imperfect substitution, the existence and location of *ego's* threshold is very sensitive to commitments by *alii*². As this holds true for all actors, it lends support for the premise that actors' implicit or explicit attempts to achieve resource alignment (Fligstein 2001) constitute a core process underlying the challenge of market formation.

The third factor concerns heterogeneity across actor contributions. The collective action literature highlights how the presence of variation in actor interest and in resources across actors is critical in facilitating collective action (Olson 1965, Granovetter 1978; Burt 1982; Oliver et al. 1985; Marwell and Oliver 1993). For example, commitments by a few with sufficient initial interest may reduce the risk of participation for others, lowering their thresholds. As more individuals begin to participate, a self-reinforcing cycle of participation is set in motion (Granovetter 1978). Heterogeneity across actors in terms of resources and strategies is prevalent in new markets and industries. Firms vary in terms of initial resource endowments (e.g., Shane and Stuart 2002), strategies and growth orientations (Kaplan and Eggers 2009, Agarwal and Helfat 2009), and in the accumulation of firm-specific capabilities (Teece et al. 1997). Likewise, organizational forms differ by an idiosyncratic subset of dominant competencies (McKelvey, 1982) and routines (Pentland and Feldman, 2005).

Building on these distinctions, we conceptualize two types of heterogeneity: variation in initial resource endowments and variation in growth strategies. Initial resource endowments refer to ex-ante generic and fungible inputs that firms possess that are then transformed into various outputs, particularly those that come to constitute the collective elements of the market infrastructure. We define growth strategies as those hard-to-

² When taking the perspective of a single actor, throughout the paper we use the terms *ego* and *alii*. We use *alii* rather than *alter* to reflect the notion that resources for market infrastructure derive from multiple other actors.

imitate unique capabilities that enable firms to extract ongoing, greater returns from the marketing infrastructure. In the community-supported agriculture example, variation in growth strategies comes natural, because each actor takes an intrinsically distinct role and performs entirely distinct tasks.

Modeling Collective Action and Market Formation

We developed a simulation model to examine how market formation is affected by imperfectly substitutable contributions and how this interacts with variation in growth strategies, initial resource endowments. We built our model on the central assumptions discussed above. Behaviorally, actors understand the basic functioning of a market infrastructure (i.e., producers understand that sales of a great product will not happen without retailers providing product availability and consumers considering those products) and effectively assess the current state of a market infrastructure. However, not knowing others' future actions, decisions to further expand this take place under uncertainty. Consequently, boundedly rational actors continuously decide on the allocation of incremental amounts of resources, based how they expect gains to develop as a result of their own actions. The model consists of three structures: actor gains and production functions, resource allocation, and heterogeneity. We briefly describe them below, providing more detail and additional illustrations in an appendix that is available in the final version. To explore the role of collaboration, we modify the resource allocation in a later section, to allow actors assessing their influence other actors' actions and vice versa.

Actor Gains and Production Functions

The market consists of N actors. An actor reaps a (subjective) value V_i from their business activities depending on the state of the market infrastructure R_i relevant to her. For example, if R_i represents the cumulative advertising and education efforts and availability of a product in retail stores then the value V_i captures sales permissible by the resulting legitimation (positive media coverage, evaluations and critiques, and a pool of consumers who actually consider the product). To develop and maintain the market infrastructure, actors allocate resources a cost C_i . Thus, actors achieve gains $g_i = V_i(R_i) - C_i(r_i)$ from their commitments to the market infrastructure.

The relation between reaped value and the relevant market infrastructure is specified by the production function $V_i = v_i R_i^{\eta_i}$, with $\eta_i > 0$ representing the value-related RtS exponent and v_i the unit value generated when $R_i = 1$. The value-related RtS exponent comprises a market-level component η as well as actor-specific variation (discussed later). When $\eta = 1$ each additional resource generates the same unit value, while smaller (larger) values provide diminishing (increasing) RtS. For example, a value larger than one corresponds with market situations where it becomes easier to achieve legitimation once collective efforts have allowed overcoming large initial resistance. Costs of achieving and maintaining infrastructure follows a similar logic except that they depend on one's own commitments r_i only: $C_i = r_i^{\gamma_i}$, with γ_i the cost-related RtS exponent. The natural bounds involve constant variable unit cost ($\gamma = 1$) and purely fixed ($\gamma = 0$). Because of importance for market dynamics is the difference between value- and cost-related RtS, we hold the market-level related RtS constant at the intermediate $\gamma = 0.5$.

Market Infrastructure and Interdependency of Contributions

The actor-specific market infrastructure $R_i = f(r_1, \dots, r_i, \dots, r_j, \dots, r_N)$ sums over resource contributions by all actors. When these contributions are imperfectly substitutable the summation is non-linearly based on the distribution of contributions. To capture this, we employ the constant elasticity-to-scale (CES) production function (Uzawa 1963; McFadden 1963) specifically designed to represent degrees of substitutability among various factor inputs, in our case the resource contributions. The CES function relies on two parameters—the cross-producer factor share parameter κ_{ji} substitution parameter ρ that respectively capture the interdependency and the degree of substitutability between actor contributions. Specifically:

$$R_i = \left(\sum_j \kappa_{ji} r_j^\rho \right)^{1/\rho} \quad (1)$$

The interdependency κ_{ji} indicates the importance of actor j 's contributions to the market infrastructure of actor i . Letting $\sum_j \kappa_{ji} = 1$ assures that the market infrastructure is scale invariant to parameter variations for $r_i = 1 \forall i$, including to the number of actors N . Further, setting the importance of cross-actor contributions equal

for all, then $\kappa = \kappa_{ij}/\kappa_{ii}$ and $\kappa_0 = (N-1)\kappa$, each bound by 0, define respectively the relative importance of individual and total cross-actor contributions. For example, the more that retailers in the contraceptive example focus on overlapping consumer segments, the larger the externalities of their education efforts on each other, the larger κ . Alternatively, when κ_0 exceeds one, actors' influence on building on the market infrastructure becomes small. In such cases market formation challenges tend to be dominated by actor apathy or freeriding (Olson 1965; Fireman and Gamson 1977). We assume moderate interdependency throughout.

The substitution parameter $\rho \in [-\infty, 1]$ measures the ease with which the resource contributions can be substituted for another. When $\rho=1$, resources are perfectly substitutable across contributions. In this case, the market infrastructure increases proportionally with each contribution, irrespective of their current mix. While we treat this situation as an extreme case for market situations (our contraceptives example), it constitutes an implicit assumption for extant collective action models (Granovetter 1978; Burt 1987; Macy 1990; Marwell and Oliver 1993). On the other extreme, when $\rho \rightarrow -\infty$, resources are non-substitutable, or perfect complements. In this case, the market infrastructure improves only when the most under-committed resources increase. When ρ equals 0, a moderate case, resource contributions are unit substitutable. In that case, the actors' market infrastructure benefits from resource contributions across actors being distributed according to their relative importance. The community supported agriculture example may be considered as such a case. In our analysis, we examine $\rho \in [-1, 1]$.

Resource Allocation

We assume that actors alter the market infrastructure through gradual resource expansion or contraction, rather than in lump sums. Thus, actors continually adjust their flow of resource allocations, or efforts, ϵ_i . They do this proportional to current resource commitments r_i : $\epsilon_i = f(\cdot)r_i$, consistent with principles of anchoring and adjustment (Tversky and Kahneman 1974). The expression $f(\cdot)$ captures how efforts change as a function of expected (subjective) gains from changing the market infrastructure, and is positive (negative) when those are above (below) zero. Under uncertainty of others' actions as well as of the consequences from large-scale changes to the market infrastructure, actors resort to simple heuristics, evaluating expected gains from

altering the current market infrastructure. Thus, actors assess the marginal gains of additional resource commitments given the state of the market at the moment of the evaluation (Burt 1982; Marwell and Oliver 1993). The scope for actors' aspired gains is subjective and may include, for varying reasons, the market as a whole. We address this later in the paper when including collaboration. For now, we assume that actors seek to advance their own gains. Thus, efforts are proportional to one's direct marginal gain from allocating additional resources, dg_i/dr_i :

$$\epsilon_i \propto dg_i/dr_i \quad (2)$$

Note that while actors are assumed to understand their own production and cost functions at the point of the current resource allocation, and can evaluate how others' contributions to market infrastructure contribute to them, we do not assume that actors can observe each other's profit functions. Thus, actors' incremental resource allocation decision heuristics conform bounded rationality assumptions (Simon 1957, 1982; Cyert and March 1963; Macy 1991).

Heterogeneity

In our model, we represent variation in growth strategies by allowing the individual-level realizations of RtS, η_i and γ_i to deviate from the market-level RtS exponents. We manipulate variation in growth strategies by changing the normalized standard deviation σ^i of actors' normally distributed RtS (η_i, γ_i), truncated at zero. The second source of heterogeneity derives from actors' initial resource endowments r_{0i} . Non-zero initial resources represent a pre-existing stock of generic resources that actors are endowed with at the beginning of the simulation and that are deployed to develop the market infrastructure. We manipulate variation in actors' initial resource endowments, like the RtS, by adjusting the normalized standard deviation σ of their normally distributed r_{0i} , also truncated at zero.

Analysis

We used the model described to analyze how collective actor market formation is affected by variation in how distinct actor contributions are interdependent. We have complemented our computational analysis

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with formal analysis of actors' thresholds, through examination of actors' commitment functions based on marginal efforts (dg_i/dr_i) and the derivation of, their equilibrium points ($dg_i/dr_i=0$), if possible. We ran simulations over 30 continuous time periods. A single period may be interpreted as ranging from months to years, depending on the type of market. The duration has been chosen such that the dynamics settle into a pattern of growth, stability, or decline. We defined the collective market formation threshold as metric of the ease of market formation, measured by the critical collective resources r_0^* necessary to achieve this. The critical collective resources r_0^* is the ensemble average from 40 simulations with outcomes $r_{0e}^* \in [1,40]$. Each ensemble simulation involves different realizations of actors' individual growth strategies and initial resources, through random draws from the two independent distributions with standard deviations σ and σ . Thus, in each ensemble simulation, when actors are endowed on average (since the distribution is σ) with initial resources beyond the critical r_{0e}^* , the market will form.

The analysis focused on, besides heterogeneity (σ, σ), variation of two key parameters : market-level RtS, through the parameter η , and the degree of substitutability between actor contributions, through ρ (Table 1). While each of the remaining parameters, interdependency κ , unit value v_i , and number of actors N , affect collective action thresholds, their dynamics have been extensively examined by collective action scholars (e.g. Marwell and Oliver 1993) and are therefore not our focus. We fix these parameters on values that permit a representative environment and controlled experimentation. First, we set the normal unit value of market infrastructure $v_i=1$, guaranteeing that a viable market exists exactly when all resources are equal to one, irrespective of other parameter choices. Hence, variation in market success truly results from market formation dynamics, rather than from variation in the difficulty of a market to exist. Further, for reasons discussed before, we perform simulations at an intermediate level of interdependency, and set $\kappa_0=0.5$. Finally, the number of actors groups (hereafter named actors) should be large enough so that we meaningfully vary growth strategies and initial resource endowments across actors. We used $N=8$. Our equilibrium analysis confirm that thresholds intuitively and conform other research increase with κ_0 , N and decrease with v_i .

Experiment 1: substitutability of resource contributions and heterogeneity

We began our simulation analysis examining how key factors of variation in substitutability of contributions and heterogeneity individually and jointly impact market formation threshold levels. The first set of findings relates to situations with perfectly substitutable contributions and reveals that heterogeneity (in both initial resource endowments and growth strategies) significantly reduces market formation thresholds. Market formation thresholds under complete uniformity rather than heterogeneity ($\sigma = \sigma^i = 0$) are straightforward. First, generally, existence of a threshold requires that value-related market-level RtS η are sufficiently large compared to cost-related RtS γ . This is intuitive, because in such situations, certainly when market infrastructure is sufficiently developed, *ego*'s value from allocating more resources increases faster than her cost. Under complete uniformity, a market formation threshold exists strictly when $\eta > \gamma$. This is so, because then, i) actors experience an individual resource commitment threshold (rather than stable equilibrium) for $\eta > \gamma$, and ii) the market formation threshold coincides with individual thresholds. Further, under complete uniformity we can analytically derive individual thresholds. Then, setting $\eta = 0.8$ (thus $\eta > \gamma$) for experiment one, yields, under complete uniformity, a market formation threshold, with $r_0^* \approx 0.81$.

The situation of complete uniformity, in which market formation is hindered by a very large threshold (r_0^* is close to one at which point each actor makes instantaneous profits), while useful as a baseline, is not very realistic. When, more reasonably, some actors are endowed with above normal resources (and others below), $\sigma > 0$, the market formation threshold is strongly reduced. Figure 1, Graph A, illustrates this effect, showing the critical average initial resources r_0^* necessary to overcome a market formation threshold (vertical axis) as a function of variation in growth strategies (σ , horizontal axis), under perfectly substitutable contributions ($\rho = 1$). The strong impact of variation in initial resource endowments on the threshold level can be seen in the case of uniform growth strategies ($\sigma = 0$), comparing point 2, on the solid line ($\sigma = 0.25$, $r_0^* \sim 0.4$) to point 1, on the dashed line (complete uniformity, $\sigma = 0$, with $r_0^* = 0.81$ as derived). Under resource heterogeneity the market effectively self-selects into contributors and non-contributors. Under moderate market-level RtS the selection mechanism is that situations where *ego* provides above average resources for the market infrastructure, the

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combination of moderate collective value increase and strong influence make her more willing to overcome her startup costs. The opposite is true for *ego* providing relatively few resources. This selective participation is not necessarily problematic as it avoids overcrowding under low commitments that occurred under complete uniformity, hindering any infrastructure buildup. Under large market-level RtS the rapid increase of value with market infrastructure, now contributions by *alii* reduce *ego*'s individual threshold. While this permits some other actors to jump on the bandwagon, with the high initial thresholds, only those with sufficient initial resources will ever overcome their threshold. This leads to the following proposition:

Proposition 1: The presence of variation in initial resource endowments reduces market formation thresholds in situations characterized by: i) moderate to high market-level RtS, ii) perfectly substitutable actor contributions, and iii) low variation in growth strategies.

From our analysis, and propositions in particular, we distill a typology to distinguish ideal type markets. As we report our findings, we highlight each respective quadrant that characterizes distinct market formation challenges in Figure 4. Proposition 1 aptly corresponds to Quadrant I which we label Resource Mobilization. Nascent markets that map onto Quadrant I include those that benefit considerably from pre-existing market infrastructure that currently serves an existing market, but can be effectively leveraged for a new market or segment such as the case of the development of a new food product line such as low fat or low salt snacks. While the success of this new category does not necessarily depend on end retailers' commitments, food manufacturers must dedicate large upfront resources into marketing and education to define the category and convince consumers of its value. The presence of several (non-collaborating) manufacturers may lead to inaction by each. However, if one food manufacturer were sufficiently endowed with substantial cash that could be allocated to market infrastructure, this firm could singlehandedly drive market formation. Then, as legitimacy and acceptance of the new product line develops, other manufacturers may also begin to benefit.

As we shift attention to markets in which actors pursue distinct growth strategies, we observe that the likelihood of market formation increases dramatically. Graph A, moving down the x-axis (increasing variation across actors' RtS σ) shows this effect. Market formation thresholds reduce to about 25%. It is this mix of growth strategies that permits not only early market infrastructure development, but also its continued growth.

When *ego* pursues a high growth strategy involving high value-related RtS (and possibly lower cost-related RtS γ), she requires very high startup resources. However, early commitments by *alii* strongly increase her perceived value of the market infrastructure, lowering her individual threshold, and thus inducing her participation. Such initial contributions are likely to come from actors with low growth strategies involving low value-related RtS, who do not face a threshold (but also do not want to contribute much). In such a case, *ego* would jump on the bandwagon if she deemed her strategy effective, once the market has developed sufficiently. Hence we observe a strong reduction of the market formation threshold as the variation in growth strategies increases.

Proposition 2: The presence of variation in growth strategies reduces market formation thresholds in situations characterized by: i) moderate to high market-level RtS and ii) perfect substitutable contributions across actors.

We label market situations that conform to proposition 2, (i.e., those characterized by different growth strategies,) Stratified Growth Markets (Figure 6, Quadrant II). Situations in which actors that come along with sufficient capabilities, insight, and/or positioning enable the growth of the market infrastructure, after experimental investment by others, is common in many high-tech and networking services industry-segments, with larger (high growth) firms invest opportunistically after smaller firms have developed novel ideas. Once the market infrastructure develops, other actors retreat from contributing to the market infrastructure.

While heterogeneity critically reduces market formation thresholds under perfect substitution, results are different under imperfectly substitutable contributions. First, variation in initial resource endowments does not suppress market formation thresholds. Graph B in Figure 1, shows results for, respectively, high, but imperfect, elasticity of substitution equal to 2 ($\rho=0.5$, represented by lines a), unit elasticity ($\rho=0$, represented by lines b), and moderate elasticity equal to 0.67 ($\rho=-0.5$, represented by lines c). While under complete uniformity thresholds coincide (points 1 in Graph B), when initial resources vary (dashed lines, $\sigma=0.25$) thresholds increase as substitutability decreases. This is apparent when comparing points 2a-c in Graph B at $\sigma=0$ to point 2 in Graph A. Further, in contrast to situations of perfect substitution, resource variation now even increases market formation thresholds (points 2a-c all exceed point 1 in Graph B). These outcomes are not immediately obvious. As the coinciding points 1 in Graph A and B show, in our simulations these higher

market formation thresholds are not caused by limited substitutability per se. Rather, under imperfect substitutability of contributions, it is the misalignment of resources that suppresses actors efforts to build market infrastructure in multiple ways. First, while, in contrast to perfect substitution, *ego* tends to contribute more to the market infrastructure when having contributed relatively little compared to *alii*, the converse is also true: when *ego* has contributed more, she gains little from contributing as long as other important contributions are not in place (as sketched in Figure 1B). Second, misalignment of committed resources makes all actors experience a lower effective market infrastructure. This in turn suppresses all actors' efforts. Thus, while actors as a collective tend to self-correct misalignment, the "bottleneck" created by a few critical contributors imposes a heavy burden on those with relatively high contributions. It is exactly those burdened actors that were potentially close to their individual thresholds and critical to the advancement of the collective good under perfect substitution.

Proposition 3: The presence of variation in initial resource endowments, due to resource misalignment, increases market formation thresholds in situations with i) moderate to large market-level RtS and ii) imperfectly substitutable contributions.

Markets with imperfectly substitutable contributions involve situations in which it matters who contributes to the market infrastructure. Considering still uniform RtS (Figure 6, Quadrant III "Collaborative Growth Markets"³), this may be the case when market infrastructure development requires commitments by multiple actors covering partitioned geographies or market segments. In such settings, markets cannot simply emerge at the hand of a single, well-endowed firm, as was the case under perfect substitution. In such cases, the emergence of a market infrastructure involves a high threshold because of the resource misalignment problem, particularly in the early stages of market formation. For example, the US wind power industry gambled, unsuccessfully, to overcome high thresholds through large-scale efforts by a few firms. In contrast the Danish wind power industry could benefit from many firms developing and contributing different knowledge components necessary to understand the diverse requirements of this nascent markets (Garud and Karnoe, 2003).

³ The name refers to the situation of collaboration that we research below

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The last set of situations we explored in this experiment involves both imperfectly substitutable actor contributions and variation in growth strategies. Assuming variation in growth strategies, we find results that further contrast with those under perfect substitutability. Figure 1, Graph B (along the x-axis, dashed lines, in particular, b and c that assume moderate ($\rho=0$) and limited ($\rho=1$) substitutability) shows that variation in growth strategies may increase the market formation threshold rather than strongly suppressing it, in contrast to the perfect substitution case shown in Graph A. Like the situation of perfectly substitutable contributions, variation in growth strategies means that some have low and others high individual thresholds. However, under conditions of imperfect substitution, actors whose strategies withhold them from investing become bottlenecks. Further, these actors also increase thresholds for other actors. Thus, the misalignment costs associated with variation in initial resource endowments across actors is now exacerbated by variation in growth strategies.

Proposition 4: Variation in growth strategies interacts with and increases the burden of resource misalignment on market formation thresholds (proposition 3), in situations with imperfectly substitutable contributions interacts. Together these effects can undo the benefits from variation in growth strategies on reducing market formation thresholds (proposition 2).

We label these Burden of Misalignment Markets (Figure 4, Quadrant IV). Market formation situations falling in this quadrant are common. These types of markets often involve actors that play distinct roles whose contributions are therefore imperfectly substitutable. Such is the case in markets such as for solar panels that involve such diverse field actors as producers, regulators, installers, suppliers, and intermediate customers. A major challenge for the formation of this market type is to achieve concurrent commitment by diverse actors. This misalignment of imperfectly substitutable resources when growth strategies vary is particularly problematic as it creates uncertainty regarding the evolution of others' long-term commitments.

Model extension: collaborative coordination

Next we examined the consequence of different forms of coordination on improving the way in which market infrastructure development is coordinated. The importance of actor interdependency compels considering the various ways that actors perceive and deal with their interdependency. While new organizations and populations must struggle to achieve legitimacy in their own right, populations achieve legitimacy more

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easily if they work together with other populations to establish standards and advance joint interests (Aldrich and Ruef, 2006). The extent to which actors have a propensity to engage in collaborative action may be driven by diverse motivations and manifest in a variety of formal and informal ways. First, a collaborative perspective may be pursued for economically rational reasons, since commitments beyond what seems marginally favorable in the short-run may be expected to yield benefits in the long-run through an altered market formation path. Such behavior is facilitated by the market roles and the way they are organized at the outset. For example, both the vertical integration of market roles (Jacobides 2005), whether by design or accident, and situations in which industry associations have a significant influence in directing and controlling collaboration between firms, foster market development. Finally, actors may contribute to growing a market and collaborate with others out of political, environmental, philosophical and/or spiritual values.

Yet, while actors' propensity to contribute to market growth may be large for exogenous and idiosyncratic grounds, the extent to which commitments to it can be maintained, is, eventually, conditioned by actions of others and how the market actually develops under such collaborative commitments. First, actors may be willing to engage in cooperative action as long as they estimate a sufficient amount of others will reciprocate and repeat such actions on similar principles (Ostrom 1998). Second, actors' propensities to engage in collaborative efforts are finite. Once a market is established, collaborative efforts tend to give way to competition (Fligstein 2001; Brandenburger and Nalebuff 1996). However, no natural transition moment to non-collaboration exists. Thus, maintaining effective collaboration is difficult and premature deviation from collaborative action may occur for various reasons, some idiosyncratic and actor related, others because of market-structural reasons, such as competitive pressures (Kollock 1998; Azoulay et al. 2010).

Taken together, our proposition is that collaboration helps overcome misalignment problems under imperfect substitution in particular. However, the irregular process by which misalignment is resolved and the market is formed makes it difficult to assess the full implications. We tested the impact of these alternative forms of coordination and their stability in respectively experiment 2 and 3. We adjusted the model to accommodate for the alternative forms of collaboration. We conceptualized collaboration in market formation settings as actors taking a market growth-based perspective. This means that actors commit resources based on

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their expectation of how the market as a whole benefits from their commitments. To capture collaboration in the model, first, an actor, when deciding how many resources to commit, not just considers her own benefits from her investments in market infrastructure, $V_i' = dV_i / dr_i$ but, also those by the market as a whole, dV / dr_i .

We reformulated the value component in the marginal gain function (equation 2) to $V_i' = V_i' + \alpha_i V_{-i,i}$ with $V_{-i,i} \equiv \sum_{j \neq i} V_{j,i}'$ capturing how the market as a whole except oneself (indicated by the set “-i”) benefits from one’s efforts. α_i controls the propensity that an actor takes a market growth perspective consistent with the general definition and intent of collaboration, in seeking to help others.

The propensity to invest in market growth is defined as $\alpha_i = \alpha (m_i)^\beta$. The constant market growth propensity parameter $\alpha \in [0, 1]$, captures *ego*’s intrinsic propensity to invest in the market. In contrast, the reciprocity term m_i captures that commitment to market growth is also subject to an evolving anticipation of how one benefits from doing this. $m_i = V_{i,i}' / (V_{i,i}' + V_{i,i})$ the relative importance of investments by *alii* to the improvement of *ego*’s market infrastructure; $V_{i,i}' = \sum_{j \neq i} V_{ij}'$ is *ego*’s benefits from commitments to the market infrastructure by *alii*, and $V_{ij}' = dV_i / dr_j$. This ratio, varying between 0 and 1, is constant under perfect substitution, with $m_i = \kappa_0 / (\kappa_0 + 1)$, because in those situations the growth of market infrastructure does not depend on relative contributions. Under imperfect substitution, however, reciprocity depends very much on who has contributed so far. In particular, a reciprocal acting *ego* is particularly willing to contribute when *alii* has contributed less. For example, for $\rho = 0$, $m_i = (\kappa_0 / \mu) / (\kappa_0 / \mu + 1)$ approaches 1 when μ (the relative commitments by *alii*) approaches 0. The market growth reciprocity parameter $\beta \in [0, 1]$ controls the extent to which an actor is sensitive to reciprocal behavior. In our subsequent analysis we focus on the extreme cases of collaboration: $\beta = 1$, implying fully reciprocal behavior, and $\beta = 0$, meaning that the propensity to commit to market growth is unconditional. The combined case of $\alpha = 1$ and $\beta = 0$, then represents the extreme situation involving a fully integrated perspective.

Experiment 2: Collaborative coordination and market-level RtS

In experiment two, we examined how collaboration and market-level RtS individually and jointly affect market formation for respectively high and low substitutable contributions. Analyzing first how thresholds and the existence of thresholds change as a function of market-level RtS, we found that, under perfect substitution, variation in growth strategies not only reduces the market formation threshold (proposition 2) but also reduces the threshold RtS, defined at the lowest market-level RtS at which a threshold exist. Figure 2 shows representative results with critical resources r_0^* (vertical axis) as a function of market-level RtS (horizontal axis). The top (bottom) graphs show perfect (imperfect) substitutability while the graphs on the left (right) show uniform resource endowments and growth strategies (heterogeneity, $\sigma=0.25$; $\sigma=0.5$). Focusing on non-collaboration ($\alpha=0$, lines marked with dot), under perfect substitution (top left), a stable, low market will form for RtS below a critical RtS of 0.8 . When actors pursue different strategies (top right), a threshold exists for considerably lower market-level RtS (compare point 1 in Graph 2A with point 1 in Graph 2B).⁴ Under imperfect substitution, the threshold RtS is not much affected by high variance in RtS because such resources become increasingly misaligned as a few seek to develop the market (Figure 2C). This variable threshold RtS, as a function of variance in RtS and substitutability is indicated in Figure 4 (Quadrants II and IV, shaded areas indicate the coexistence of stable as well as threshold markets).

Turning to collaboration we anticipated and found considerably reduced market formation thresholds. While these findings extend to and for some measure are largest for the most problematic situations involving imperfect substitutable and varying growth strategies, in those cases the degree of improvement is very inconsistent across (random) draws. Figure 2 shows how collaboration reduces the threshold-RtS in the case of complete uniformity: Compare within Graph A and C, the dot (non-collaboration) with the square (reciprocal collaboration) and triangle (integrative collaboration) on the left. Reciprocal and integrative collaboration reduces the threshold in this case by about 40% and 80% respectively. Likewise, they reduce threshold levels

⁴ Around the threshold-RtS the critical resources may be very high, only to stabilize for larger RtS. This is so, because around the threshold-RtS value- and cost-related RtS are very close to each other. Whether around this point the market infrastructure grows or declines, it will evolve very slow.

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(Graph A compare point 1 downwards). Market growth oriented commitments facilitate overall resource commitment, reducing the duration of uncertainty of whether a market will succeed or fail.

Proposition 5: Collaboration, respectively of the reciprocal and integrated form, increasingly reduce market formation thresholds in situations characterized by: i) moderate to strong RtS markets and ii) uniform growth strategies, irrespective of substitutability of contributions.

Collaboration is an important form of coordination between entrepreneurial seeking to achieve legitimacy of a new product category in early stage market formation (Navis and Glynn, 2010). However, under uniform contributions, collaborative commitments are not sustainable and eventually only a few will continue to develop the market (Quadrant I). For example, satellite radio identity emerged through explicit collaborative efforts between key players Sirius and XM. However, once the market infrastructure was sufficiently developed each pursued a fiercely competitive growth strategy (Navis and Glynn, 2010). As is the case in Quadrant 1, this proposition suggests collaborative efforts are critical in more complex market formation in the case of Quadrant III, in which actors share goals of collective identity development, but that also need a diverse base of legitimacy or knowledge development to convert resources into value. In such cases, actors' collective movements may help create such markets. For example, the Danish wind thrived under a culture of openness across many small producers (Garud and Karnoe 2003). Under imperfect substitution collaboration is expected to be relatively sustainable because it tends to induce collaborative commitments from those who have committed fewer resources, in particular when collaboration is integrated, reducing the misalignment problem. Indeed, in some contemporary industries such as open source innovation this form of coordination is institutionalized.

The role of collaboration in situations when growth strategies vary is more equivocal. In particular, we find that collaboration strongly improve market formation under imperfect substitution markets where mere variation in growth strategies did little to do so (graph D). In fact, the relative benefits of collaboration are most pronounced in those situations particular from integrative collaboration. Nevertheless thresholds remain above those for perfectly substitutable contributions (graph B). Low growth strategy actors, who play a relatively small role in perfect substitution markets, may have a sufficiently large propensity to collaborate, importantly

reducing resource misalignment. Together, these regularities suggest that a market growth orientation may be instrumental in overcoming large misalignment in the context of imperfectly substitutable contributions, even when actors vary in their RtS (Quadrant IV). However, while collaboration may set in motion a self-fulfilling process of misalignment reduction and market development, this process is also failure prone when growth strategies vary. Bottleneck actors face a tradeoff because their intrinsic motivation to contribute is small, despite a potentially large enough propensity to collaborate. Therefore, we observe a large variation in threshold levels across draws from the distributions, except when collaboration is integrative (graph D, error bars).

Proposition 6: Variation in growth strategies between actors, in situations characterized by imperfectly substitutable contributions, results in large variation of the benefits of reciprocal collaboration across cases.

Experiment 3: Defecting from collaboration under heterogeneous contributions

In the final experiment we allowed actors to defect from market growth based commitments altogether. To analyze this we modified the market growth propensity, making it conditional upon an evaluation comparing returns from collaboration with those expected from non-collaboration. Actor's perception on the benefit from collaboration forms a simple moving average (smoothing of noisy information) δ^* of a continuous string of binary evaluations $\delta=\{0,1\}$, where a value of 1 favorably evaluates market growth. As long as the recent mix of evaluations is favorable actors continue following the market growth based perspective α_i ; otherwise they resort to non-collaboration. A defection threshold $\delta=[0,1]$ controls the evaluation value δ^* at which actors actually defect from collaboration. A threshold level of $\delta=1$ means that an actor will never take a collaborative perspective (conform experiment 1). In the other extreme, when $\delta=0$, an actor will never defect from collaboration (conform experiment 2).

Our findings show that collaboration of imperfectly substitutable contributions, while critical, is highly fragile under heterogeneity. Starting from the results in Figure 2 we varied the propensity to defect $\delta=\{0,0.25,1\}$ and measured how this affects the average critical resources r_0^* to overcome a threshold. Figure 3 summarizes results, focusing on moderate substitutability ($\rho=0$), with $\delta=0.25$ are shown as dashed lines. We

observe two striking results. First, collaborating actors that can and do follow similar growth strategies, and whose resource commitments are aligned, will not defect from collaboration (Graph A, corresponding with Figure 2, graph C, dotted lines overlap with the lines that assume sustained collaboration). This is so, because with each actor behaving according to others' expectations they jointly self-fulfill the prophecy of benefits from additional resources. However, defection increases thresholds under moderate variation in initial endowments (graph B, $\sigma = 0.25$) in particular for integrative collaboration. Integrative collaboration is vulnerable to defecting because the over-commitments are larger, in particular from those parties with low interest (bottlenecks). The perverse results are particularly prominent when growth strategies vary (graph C). Defecting now takes away almost all benefits of reciprocal combination. This is so, because some actors (those with high commitment shares) now perceive that market players (those with low commitment shares and low RtS) do not reciprocate sufficiently, which induces them to defect to market-based commitment behavior.

Proposition 7: Variation in growth strategies, in situations characterized by imperfectly substitutable contributions, increases the likelihood of defection from collaboration, which increases market formation thresholds to close to those of non-collaboration.

Markets that fall under Quadrant IV (Figure 4) are thus particularly vulnerable to defecting. In the solar industry example, while market formation may benefit from reciprocal behavior, allowing advanced solar producers to push the market infrastructure further, when those producers perceive that installers and others catch up too slow, sense that their collaborative commitments are futile.

Discussion and Conclusion

While extant literature on market formation invokes collective action as a central component of the emergence of new markets, it has underspecified its nature and its associated boundary conditions in new market settings. We have sought to redress this gap by highlighting collective action dilemmas and how they impact possibilities for new market formation. In so doing, we have developed a simple and flexible formal model that can be applied to a number of settings. From this, we developed a general theory of market emergence and an accompanying typology that synthesizes the broad range of existing market and industry emergence studies.

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Our analyses generated several important specific findings. First, consistent with extant formal models of collective action, we find that variation in initial resource endowments and variation in growth strategies both decrease market formation thresholds under conditions of perfect substitutability across actor contributions and under medium to high market level returns to scale (Quadrants I versus II). Second, providing an important scope condition for the first set of findings, when actor contributions are imperfectly substitutable, the beneficial effect of both types of variation (initial resource conditions and growth strategies) on market formation thresholds is severely weakened. In fact, when growth strategies vary in situations of imperfect substitution (Quadrant IV versus III) market formation thresholds may even increase, contrasting those of perfect substitution where this variation is instrumental in facilitating market formation.

The central factor hindering market formation in those cases is resource misalignment. Misalignment occurs when the effectiveness of the market infrastructure (such as standards, legitimation, knowledgeable workforce, codes, product categories, or regulations) depends on the distribution of distinct resources, while those resources have been committed unevenly. In particular, misalignment hinders market formation because those actors who have contributed more than others—those who could otherwise be close to their individual threshold—realizing that their contributions are ineffective. The problem of misalignment is reinforced when actors differ in their growth strategies because some actors whose contributions have little impact on overcoming the market formation threshold continue to commit resources, while actors whose contributions are critical to successful market formation undercommit the necessary level of resources.

Given that many markets are characterized by imperfectly substitutable contributions (specifically, Quadrant IV), and that this condition complicates attempts to achieve market formation, our third set of findings center on the role of explicit collaboration. We find that market formation thresholds can be importantly lowered with greater degrees of collaboration. The effectiveness of the various forms of collaboration depends heavily on the extent to which contributions are heterogeneous and the benefits from collaboration are strongest in situations where resource misalignment is greater. Most interestingly, however, our analyses point to a market emergence conundrum: While the relative benefits from high degrees of collaboration (under reasonable conditions) increase with imperfectly substitutable actor contributions and

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variation in their growth strategies, these results are reversed when actors can defect from collaboration. While the market as a whole benefits greatly from collaboration, the extent to which this is true for each actor varies greatly depending on the perspective of individual actors at any point in time. This in turn initiates a vicious cycle in which market actors tend to fall back into non-collaborative situations characterized by high thresholds. The possibility of premature dissolution of collaboration is most likely under conditions of imperfectly substitutable contributions and where resource misalignment is present (situations mapping onto Quadrant IV). These findings point to the importance of the interaction between variation in actor contributions and the form of coordination and suggest a conundrum: confidence in other actors contributions is most important where it is least present. This suggests that the formation of such markets, which usually cannot benefit from very high and sustained confidence across actors, then requires government support, or fully integrated activities.

Our market formation typology not only provides a generalizable theory for distinct empirical realities, but also nicely maps a range of research traditions and approaches to the study of market formation. For instance, single population studies that have dominated much of population ecology, institutional theory (Dacin, Goodstein, and Scott: 2002: 50) and industrial organization (Gort and Klepper 1992) are well represented by Quadrants I and II. Early work in population ecology is representative of Quadrant I given their assumptions regarding how organizational form density leads to cognitive legitimacy. These assumptions are strikingly similar to those made in conventional collective action models regarding actor contributions because the density of organizational form argument assumes that within form heterogeneity makes no difference for the achievement cognitive legitimacy; greater numbers simply lead to increased legitimacy. Other work focuses on within-form material and symbolic resource heterogeneity and its impact on key ecological outcomes such as foundings and failures (e.g., Rao, 1994) and therefore fits more comfortably in Quadrant II. Such an approach is also consistent with broader sensibilities of strategy research focused on firm-specific capabilities and resources that imply distinct growth strategies among organizations within the same population (Barney, 1991; Penrose, 1959; Peteraf, 1993). By contrast, research that focuses on the role of multiple actors within an organizational field (Scott et al., 2000), community of organizations (Freeman and Audia, 2006; Ruef 1999; Ruef and Patterson, 2009), value chain (Porter, 1980; Adner and Kapoor, 2011) or industry architecture

(Jacobides, 2006) aptly fit into Quadrants III and IV. Our theory suggests that it is in those quadrants that we get the largest likelihood of failure, despite a significant common interest.

Our findings hold significant implications and contributions for a number of theoretical traditions, which we outline below. In deriving a typology of market emergence situations (see Figure 6) from our simulation, we avoided several criticisms associated with the use of typologies. Our use of a simulation to derive this typology results in a clear specification of the causal processes operating within each “type” of market emergence situations. We have: 1) made explicit our broad theoretical assertions regarding market emergence, 2) defined the set of different “types” of market emergence situations and described each using the same set of dimensions, 3) and, 4) have articulated the assumptions about the importance of the various features that differentiate each type of market situation (i.e., actor contribution substitutability, market level returns-to-scale, and variation in growth strategies). By so doing, we provide a broader theoretical approach to market emergence that generalizes to all settings (within the parameters of our assumptions) and offer more “middle-range” theories for market emergence situations (Doty and Glick, 1994).

Our findings stress the importance of placing greater theoretical and empirical consideration of distinct actors and their attributes relevant for successful market formation. While a substantial body of research point to the importance individuals and collective actors that serve as institutional entrepreneurs in new field and market creation (DiMaggio, 1988; Dorado, 2005; Garud, Hardy, & Maguire, 2007), our explicit focus on multiple actors that possess distinctive sets of resources builds on and extends work that has emphasized the importance of multiple and varied actors to new technology markets (Van de Ven and Garud, 1993) and more recent work that considers supply and demand-side actors in developing new market categories (Weber et al., 2009). Increasingly, field level studies have attended to a wider array of relevant actors in a given field (see Wooten and Hoffman, 2008 for a recent review) but have focused less attention to the criticality and substitutability of the particular resources, identities, and roles of each actor.

A second contribution to market formation studies is to reinstate the centrality of collective action dilemmas to market formation dynamics. To date, many studies of market formation evoke language of

collective action and document its existence in the context of market formation. Yet, despite this emphasis, there is limited theoretical or analytical consideration of collective action thresholds and the means by which they are overcome. Many studies on market formation emphasize the challenge of achieving legitimacy, but tend to skirt issues of overcoming collective action dilemmas that often lie at the heart of attaining legitimacy. This gap in the literature is not unexpected given that most studies of industry emergence focus on those markets that successfully emerged (Aldrich and Fiol, 1994). While markets and industries that have survived long enough to have data gathered on them may still struggle with being perceived as a legitimate market, they have likely overcome critical collective action problems. As a result, it is no surprise that scholars have tended to neglect such problems because their resolution generally inheres in, and are disguised by, successful market formation. However, such neglect is particularly problematic because *how* collective action dilemmas are resolved structure and direct subsequent action and behavior that has a significant impact on future market formation success or failure and for the actors involved. Thus, to truly develop a more accurate “collective action-based orientation to the study of entrepreneurship” (Sine and Lee, 2009), careful theoretical and empirical attention to the timing of when actors enter the new market space, what they specifically contribute to the development of shared market infrastructure, and the specific collective actions they engage in is crucial to advance this agenda. We hope that this paper spurs future research in this direction.

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Figures and Tables

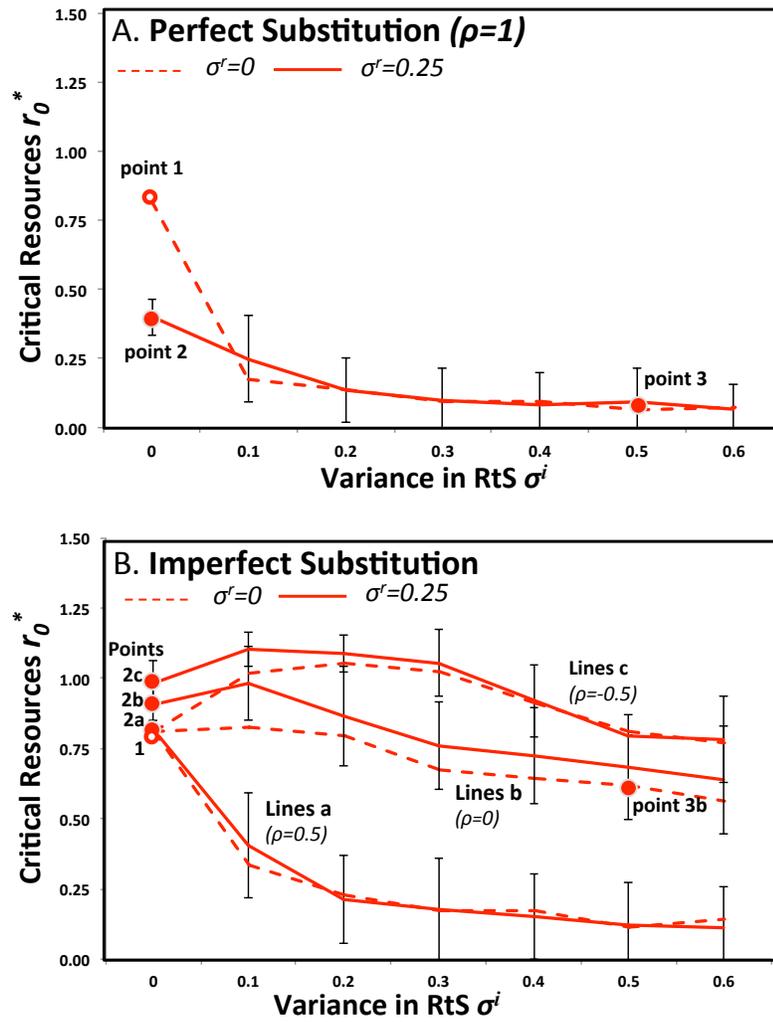


Figure 1. The impact of Heterogeneity and Substitutability on Market Formation thresholds

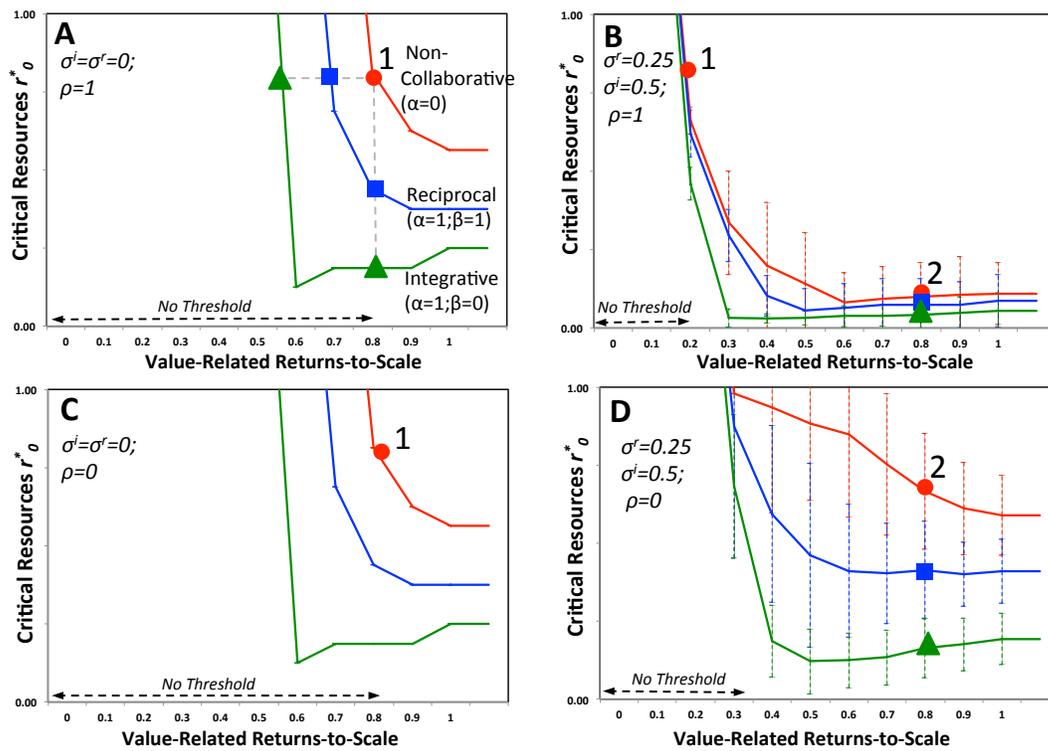


Figure 2. The impact of Collaboration on Market Formation thresholds

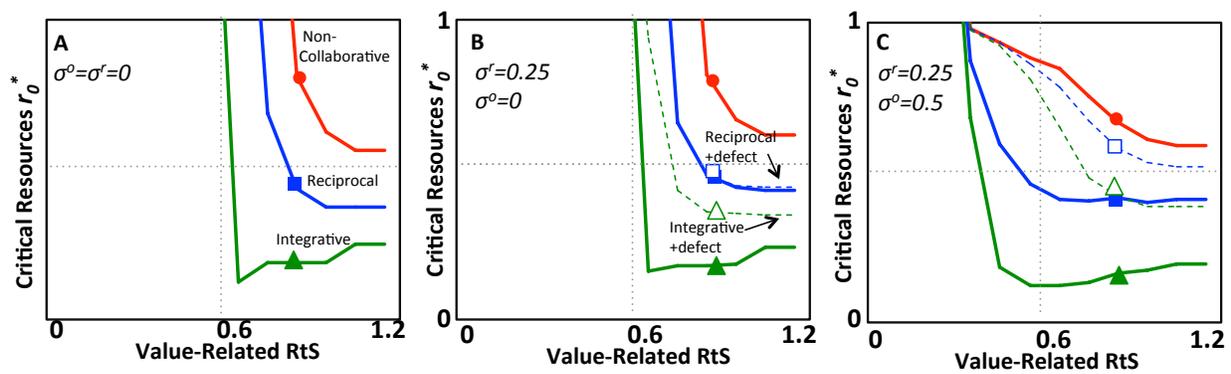


Figure 3. The Impact of Defection from Collaboration on Market Formation Thresholds

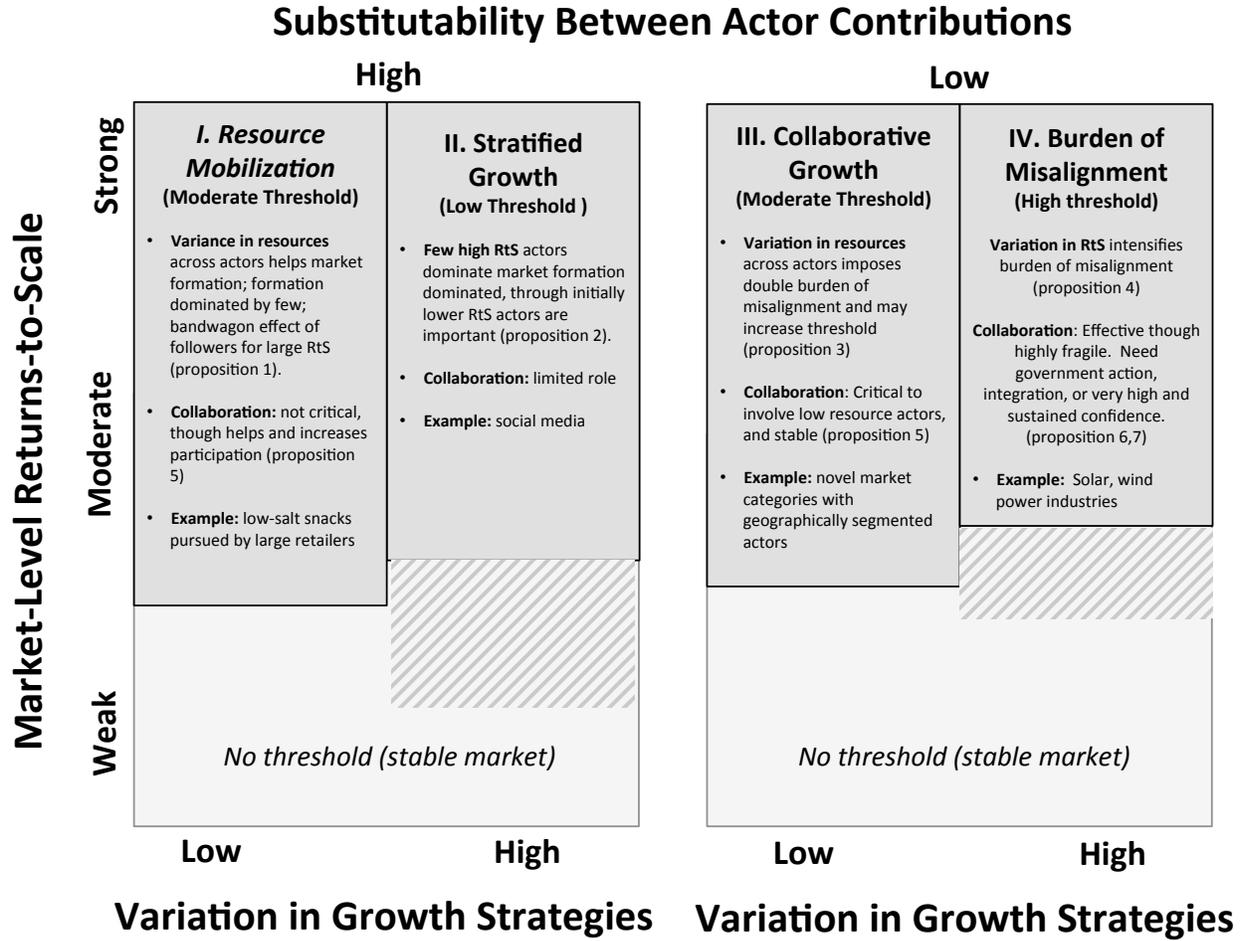


Figure 4. Typology of market formation classifying the role and nature of collective action needed for successful market formation.

Table 1. Model Parameter Settings

Parameter		Default value ¹	Comment
η	Value-related returns-to-scale	1 [0,1.5]	A value of 1 provides constant-returns-to-scale; η needs to be compared to the cost-related returns-to-scale γ , which is held constant at 0.5.
σ	Variation in actor' interests	0 [0,1]	Measures the standard deviation in returns-to-scale across actors exponents (η and γ) across actors, holding their average constant. $\sigma=0$: all actors experience the same production function
σ	Variation in actors' initial resource endowments	0 [0,0.5]	$\sigma=0$: all actors have the same initial resource endowments
ρ	Substitutability between actor contributions	1 [-1,1]	Indicates the degree of interchangeability of resources commitments across actors $\rho =1$: perfect substitutes (implicit conventional assumption) $\rho =0$: unitary elasticity of substitution $\rho =-1$: complements

¹ This column lists, respectively, the value assumed for the base line simulation, the analyzed range of operation during sensitivity analyses.