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**Perception and pursuit
of entrepreneurial opportunities:
an evolutionary economics perspective**

by

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Abstract:

Considerable debate surrounds the concept of entrepreneurial opportunities. This paper contributes to the discussion by bringing in concepts and findings from evolutionary economics. It makes three points. First, adopting an evolutionary market process perspective sheds new light on the nature of opportunities. Second, not only the pursuit of entrepreneurial opportunities, but also the further development of the entrepreneurial venture is dependent on subjective opportunity perception and interpretation. Third, findings on industry evolution help understand how opportunities, as well as agents' ability and willingness to pursue them, change over time. Effects of pre-entry experience on opportunity recognition and firm performance are also discussed.

JEL classifications: B25, D21, M13, L10.

Key words: opportunities, market process, business conceptions, industry evolution, spin-offs.

1. Introduction

Clearly defining the scope and boundaries of its field has proved challenging for entrepreneurship research. Thinking about entrepreneurship in terms of opportunities, their discovery and exploitation is a promising approach to dealing with this challenge. The opportunity concept allows entrepreneurship theory to build on earlier work in economics. At the same time, it helps put into perspective the dichotomy between “Schumpeterian” and “Kirznerian” entrepreneurship that still figures prominently in economics, and allows for an integration of corporate and other forms of entrepreneurial activity that do not come with new firm formation. In spite of these promising features, a considerable conceptual debate surrounds the opportunity concept. This paper adds to the discussion of entrepreneurial opportunities by relating the opportunity concept to three strands of research in evolutionary economics.

The historical origin of the opportunity concept, which emerged in the context of market process theories developed in the Austrian economics tradition, provides the conceptual point of departure for the present analysis. The genesis of the concept is not just interesting on historical grounds. Rather, recognizing that individual entrepreneurial activities are embedded in the market process is highly useful to clarify the nature of opportunities, as they are mostly created as by-products of market processes. The evolutionary market process perspective moreover indicates the importance of agent motivation for opportunity recognition. The analysis then shifts to the organization level. Based on recent conceptual work in evolutionary economics, subjective elements in entrepreneurial opportunity perception and pursuit are highlighted. They reflect the entrepreneur’s organizational socialization and shape the development of new entrepreneurial ventures. The significance of the present argument is to underline that it is not only the perception and initial pursuit of the entrepreneurial opportunity that are inherently conditioned by subjective, idiosyncratic factors, but also the further development of the entrepreneurial venture. A conceptual link between new firm formation and firm development is thus established. Finally, the industry context of opportunity pursuit is taken into account. Drawing on a wealth of recent empirical evidence, I show that basic industry characteristics are affecting the extent and kind of opportunities and their development over the evolution of an industry. In addition, empirical evidence from industry studies is presented that indicates the strong effects of pre-entry experience on post-entry performance.

There is substantial common ground between entrepreneurship research and evolutionary economics. Both fields tend to define themselves in terms of their objects of inquiry while being open to a broad spectrum of methods and behavioral assumptions. In addition, the objects of analysis of evolutionary economics and entrepreneurship overlap to a substantial degree. By approaching a debate that is at the core of entrepreneurship research from the perspective of evolutionary economics, this paper endeavors to shed new light on the issues and to suggest new avenues to approach them. In addition, a more modest but nonetheless valuable objective is pursued. The present analysis points out to what extent entrepreneurship research and evolutionary economics share common intellectual roots and interests. Awareness of these commonalities may help researchers identify, and subsequently benefit from, relevant work generated outside their respective communities.

The remainder of the paper is organized as follows. Section 2 discusses the Austrian roots of the opportunity concept. Section 3 embeds the notion of entrepreneurial opportunities in an evolutionary market process perspective. Section 4 introduces evolutionary concepts that provide links from the subjective perception of opportunities to the specific way they are pursued and the further development of the entrepreneurial venture. Section 5 presents findings on industry evolution to trace the dynamics of entrepreneurial opportunities over time in different kinds of industries. Also based on empirical work in industry evolution, section 6 discusses the impact of pre-entry experience on the pursuit of opportunities. Section 7 concludes.

2. The Austrian economics roots of the opportunity concept

The roots of the opportunity concept are found in Austrian economics. It is implicit already in Hayek (1945) who alludes to the role of arbitrageurs discovering, exploiting, and eliminating local differences in commodity prices. The insight that agents differ in their “knowledge of the particular circumstances of time and place” (ibid., p. 522) provides the cornerstone of Hayek’s characterization of the market process. This subjective, localized knowledge of individual agents is reflected by competitive prices signaling relative scarcities and how these change over time and between locations. Price differences give rise to arbitrage opportunities, and the exploitation of these opportunities equilibrates the market. Emphasizing the self-regulating capacity of the market process, Hayek does not seem to see as potentially problematic the underlying capacity of agents to discover and pursue opportunities. He trusts individual market participants to reliably act on their recognition, based on their subjective

knowledge, of arbitrage opportunities. With this optimistic view of the market process, Hayek remains faithful to the tradition of liberal economic thinkers. At the same time, there is no specific role for the entrepreneur in his view of the market process.

Building on prior work of von Mises (1949), this changes in Kirzner's (1973, 1997) work where the entrepreneur takes center stage. According to Kirzner, it is characteristic for entrepreneurs that they are "able to perceive opportunities for entrepreneurial profits; that is, they are able to see where a good can be sold at a price higher than that for which it can be bought" (1973, p. 14). These opportunities derive from imperfect knowledge, i.e., exactly from the subjective differences in knowledge of time and place that were already emphasized by Hayek. Kirzner (1997) suggests errors as an additional source of opportunity so that entrepreneurial activity is seen as helping correct earlier shortcomings in judgment. In this way, the market process is seen not only as self-regulating, but also as self-correcting – the competitive process thus becomes a substitute for less than perfect individual rationality and foresight.

For Kirzner, all human behavior has an entrepreneurial element. As a hypothetical, analytical device, he introduces the "pure entrepreneur" whose "entire role arises out of his alertness to hitherto unnoticed opportunities" (ibid., p. 39, emphasis in original). The pure entrepreneur does not initially own any resources. She is an arbitrageur who buys goods or resources and is able to sell them at a profit, because she is more adept or quicker than others in reacting to imperfections or changes in the market. Neither production activities nor firm ownership are defining elements of Kirzner's notion of entrepreneurship, which is developed in the context of a pure exchange economy. Producers nonetheless qualify as Kirznerian entrepreneurs because (and to the extent that) they buy bundles of resources and process them into goods that can then be sold at a higher price than what had to be paid for the original bundle. It is the element of (intertemporal and combinatorial) arbitrage present in profitable production activities that makes them entrepreneurial in the Kirznerian sense.¹

Entrepreneurs are thus defined by their alertness toward unexploited – and exogenously given – opportunities that are reflected in price differences. For Kirzner, innovativeness, in the sense of bringing novelty into the economic sphere, is not a necessary or even defining element of entrepreneurship. Moreover, alertness to the information signaled by price differences is more important for the entrepreneur than superior substantive (e.g.,

¹ The parallels between Kirzner's view of entrepreneurship and the resource-based theory of the firm are noteworthy. The individual ability to exploit arbitrage opportunities through production depends on differences in the subjective valuation of resources. Barney (1986) likewise argues that for resources to be strategic, subjective differences in their (expected) values are necessary.

technological) knowledge or creativity. Nor does Kirzner discuss how the entrepreneur pursues the opportunity once it has been discovered. Specifically, there is no role for the firm organization in his scheme (Witt, 1999).

With Joseph Schumpeter, there is a second eminent Austrian – at least by birth² – whom both evolutionary economists and scholars of entrepreneurship count among their intellectual predecessors. In Schumpeter, the opportunity concept is not explicitly featured. Instead, his point of departure is the notion of innovation characterized by him as “new combination” (Schumpeter, 1911). The entrepreneur is an individual who creates a new combination and pursues it in the market (possibly but not necessarily through forming a new firm). Clearly, the creation of a new combination can be interpreted as the creation of an entrepreneurial opportunity. If interpreted in this way, Schumpeter’s approach differs from the Hayek-Mises-Kirzner tradition in that opportunities are not presupposed for entrepreneurial activity to occur, but are created by the innovative entrepreneur herself.

This interpretation of the Schumpeterian entrepreneur as a creator of opportunities is limited to the narrow economic market sphere, however. At a more fundamental level of analysis, even the Schumpeterian entrepreneur is an exploiter of preexisting opportunities (Witt, 2002). Schumpeter makes a strong distinction between entrepreneurs and inventors. Innovative entrepreneurs are by no means required to be inventive in a technical sense, but the entrepreneur (as such) exploits an existing opportunity by bringing it into the economic sphere. Put differently, while the Kirznerian entrepreneur discovers and pursues opportunities that exist within markets (and are reflected in the price system), the Schumpeterian entrepreneur discovers and pursues opportunities that exist outside the economic sphere (and are not yet reflected by the price system) by bringing them into the marketplace. The important economic implication of this difference is that entrepreneurial activities have a fundamentally different effect on the market process: while in Kirzner’s view they are equilibrating forces, Schumpeter sees them as the crucial drivers of dis-equilibrating economic development.³

The picture becomes even more complex when Schumpeter’s later position on innovation and entrepreneurship is taken into account. Schumpeter (1942) argues that in the

² Contemporary Austrian economists tend not to accept Schumpeter as one of their own, even though his analysis focused on process and development, and in spite of the strong subjectivist element in his (early) entrepreneurship theory. Schumpeter’s position toward socialism seems at least in part responsible for this rejection (see, e.g., Koppl and Minniti, 2003, pp. 86-7).

³ This stark economic contrast between Kirznerian and Schumpeterian entrepreneurs is not paralleled by equally pronounced differences between the concrete kinds of the opportunities that they pursue. Some of the specific kinds of “new combinations” discussed by Schumpeter (1911, ch. 2), particularly those based on new markets or new inputs rather than product, process, and organizational innovations, are quite similar to the arbitrage opportunities emphasized by Kirzner.

course of economic development, the individual entrepreneur becomes increasingly unimportant. Instead, corporate firms with R&D activities of their own, driven by the incentives given by the patent system, take over as the prime drivers of technological and economic change. In retrospect, this was of course a rather weak prediction. Its significance for the present discussion, however, derives from the fact that with corporate R&D, the opportunity is no longer exogenously given even in the technological sense, but is created by the innovating firm itself.

The crucial implication of the Austrian origins of the opportunity concept is that opportunities are approached from a more global position informed by an interest in market processes. In the next section, this position will be adopted and extended to reconsider the contemporary debate on entrepreneurial opportunities.

3. The market process and the existence of opportunities

The Austrian legacy is clearly visible, and is readily acknowledged, in the contemporary treatment of the opportunity concept in entrepreneurship research. However, entrepreneurship researchers have not converged on a universally agreed upon definition of entrepreneurial opportunities, and the alternative views incorporate Austrian concepts in different ways. In particular, there are conflicting views as to whether entrepreneurial opportunities exist in an objective way or whether they are more subjective in nature, being actively created by the entrepreneur herself.

Shane (2003, p. 4) defines entrepreneurship as “an activity that involves the discovery, evaluation and exploitation of opportunities to introduce new goods and services, ways of organizing, markets, processes, and raw materials through organizing efforts that previously had not existed.” In this view, opportunities exist prior to and independent of the entrepreneur’s discovery and subsequent actions. They arise from factors such as technological, social, and demographic change. Shane’s definition is very close to Kirzner’s in stressing the discovery of existing opportunities, while he distinguishes forms of opportunities along the lines of Schumpeter’s (1911) types of innovation.

Shane (*ibid.*, pp. 19-22) introduces a distinction between “Kirznerian” and “Schumpeterian” opportunities based on whether or not an opportunity involves the introduction of new information or only differential access to existing information. Without a more specific characterization of what kind of information (or knowledge) is referred to, this distinction remains rather vague. To argue that “Schumpeterian” opportunities involve the

creation of new knowledge glosses over Schumpeter's prominent distinction between inventors and innovators. Also, a distinction between newly created knowledge and unevenly divided knowledge is hard to make operational if frequently ("Kirznerian") opportunities for arbitrage are the direct results of prior (possibly erroneous) decisions by other agents that lead to changes in the relative scarcity of particular goods and resources. It is (new) knowledge about these changes that allows for arbitrage. In the absence of change, all opportunities for arbitrage would rapidly dry up. All opportunities are thus created by new knowledge. The crucial difference between opportunities for arbitrage and opportunities based on radically new products or technologies is the extent to which the existence of an opportunity is signaled by the price system, i.e. whether or not the new knowledge exists in the market or only outside of markets.

It is important to note that for Shane, the ability to discover opportunities involves more than merely alertness. In contrast to Kirzner, discovery of opportunities is not (only) a question of personality traits. Rather, to discover an opportunity a potential entrepreneur needs to be both exposed to information related to it and capable of recognizing it as an opportunity. For the latter, relevant prior knowledge is seen as crucial, which is accumulated in the entrepreneur's prior experience. Differences in prior knowledge also condition how exactly an opportunity is interpreted, and how it is translated into products and entry into specific markets (Shane, 2000).

Shane (2003, p. 42) stresses that opportunities may exist as objective realities even though their discovery may require a creative act by the entrepreneur. In contrast, Sarasvathy et al. (2003) dispute the objective nature of all entrepreneurial opportunities. They distinguish three types of entrepreneurial opportunity, which they relate to three different views of market coordination in economics. Opportunity "recognition" is related to the tradition of neoclassical economics. Recognition of opportunities is sufficient if both demand and supply factors "exist rather obviously" (ibid., p. 145), and if the entrepreneurial venture exploits already existing markets. Arbitrage and franchising are given as examples of this kind of opportunities. If either demand or supply factors are absent in the market prior to the entrepreneurial venture, the entrepreneurial activity is characterized as opportunity "discovery." New products for well-known needs and desires, as well as new applications for existing technologies, fall into this category, which is linked to the Austrian tradition of market process theory. Finally, opportunities may be actively created by the entrepreneur herself. According to Sarasvathy et al. (2003), this happens when neither demand nor supply exist prior to the entrepreneurial venture, but both sides of the market have to be created

anew. This view of active creation of opportunities is related to Buchanan and Vanberg (1991) who explore parallels between economics and complex systems theory. These authors suggest that markets are creative processes in which agents create new goods in unforeseeable ways.

The core of Sarasvathy et al.'s (2003) position is that entrepreneurial activity may require the active creation of an opportunity, and market conditions determine the extent to which opportunity creation is necessary. However, Sarasvathy et al.'s (2003) mapping between kinds of opportunities and economic positions appears unfortunate. For example, Kirzner's defining case of entrepreneurship, arbitrage, ends up being linked to the neoclassical tradition that he strongly objects to. Generally, a distinction based on whether none, one, or both sides of the market have to be "made" by the entrepreneur appears poorly suited as a foundation for classifying entrepreneurial opportunities.

For a closer look at Sarasvathy et al.'s (2003) classification of opportunities, it is helpful to start with the conception of competition and the market process adopted by evolutionary economics.⁴ Evolutionary economics builds on the Austrian approach by embracing subjectivism and a process orientation. At the level of the individual, evolutionary economists join the Austrian school in recognizing the limitations of the traditional economic approach assuming rationally optimizing, representative agents. Instead, evolutionary economics allows for subjective cognitive framing, satisficing, learning, and creativity in human behavior. The population thinking underlying evolutionary thought, i.e., the emphasis on the heterogeneity of similar entities such as firms, is the analog of Austrian subjectivism at the organizational level. In terms of its process perspective, evolutionary economics goes beyond the (narrowly conceived) Austrian approach in that not only the coordinating power of the competitive market process is highlighted, but also its capacity to trigger dynamic change and innovation. The evolutionary conception of the market process thus has a direct link to Schumpeterian entrepreneurship and innovation.

The evolutionary market process is in part driven by the feedback provided by price information. Given the evolutionary assumptions on human behavior, changes in prices need

⁴ Evolutionary economics is a heterogeneous field. Following the seminal contribution by Nelson and Winter (1982), a substantial fraction of evolutionary economists build their conceptual models on the variation-selection-retention scheme of Darwinian evolutionary biology. Consequently, the application of this scheme is sometimes proposed as the defining characteristic of the evolutionary approach. This position is not unequivocally accepted in the evolutionary economics camp, however (cf. Foster, 1997; Witt, 2003; Cordes, 2004). Following a more inclusive characterization, the crucial feature of evolutionary economics is an emphasis on processes of endogenous development and change rather than equilibria and the adjustment toward them. Witt (2003, p. 13) defines evolution as the "self-transformation over time of a system under consideration," where self-transformation is specified as the emergence and dissemination of novelty. According to this definition, novelty is the cornerstone of an evolutionary approach to economics.

not be due to errors in judgment, but may arise for a variety of reasons, e.g. changes in tastes or consumer learning.⁵ For existing producers, price changes provide signals that demand for their products has changed. For potential entrepreneurs, they may signal opportunities for profitable entry. Increasing prices indicate opportunities for arbitrage. In contrast, falling prices are a signal for existing producers that their performance is declining, which may trigger increasing innovative efforts. Innovation is then the consequence of deteriorating performance. At the same time, successful firms can use their profits to finance further innovative activities, in which case past success may also breed future success. Either way, innovation is conditioned by performance, which in turn is affected by the activities of competitors. Consequently, one firm's innovation may be the unintended result of another firm's earlier innovation. In the evolutionary view, competition is a dynamic process in which the actions of the various firms are continually in flux and mutually interdependent. Unless the ensuing opportunities are all exploited by incumbent firms, the market process also generates a stream of opportunities for entrepreneurial entry. The dynamic, open-ended market process, which has been characterized as self-organizing (Witt, 1985), accordingly generates a stream of new entrepreneurial opportunities.

A basic insight from adopting an evolutionary market process perspective is that at the aggregate level, the vast majority of entrepreneurial opportunities are created by human activity rather than preexisting exogenously. (Opportunities stemming from natural disasters etc. are an exception.) They may be created outside the market sphere (e.g., opportunities based on new inventions and scientific discoveries), but often arise in the market process itself, being the (mostly unintended) consequence of some agent's prior activities. To ask whether opportunities exist exogenously or are actively created therefore seems little meaningful. Essentially, the controversy on entrepreneurial opportunities is about whether or not the opportunity is exogenous to the entrepreneur's *own* activity, i.e., whether the entrepreneur created the opportunity or some other agent did. However, this modified distinction remains insufficient. Even if the entrepreneur created the opportunity through her own invention or market activity, it is important to understand the underlying motivation.

Quite possibly, as in the case of a targeted technological development, the motivation behind the creation of an opportunity was the discovery that an "opportunity to create an opportunity" existed. In this sense, the discovery of an (individually) exogenous "higher-order opportunity" preceded the creation of the opportunity. Alternatively, the opportunity may arise from the entrepreneur's own activity that was not directed toward entrepreneurial

⁵ Schumpeterian innovation is among the possible causes of changes, but in contrast to Schumpeter's (1911, ch. 2) view of the consumer as passive and easily manipulated, changes may also originate on the demand side.

purposes. For example, an academic in her research activities may find a new material or genetic function that – in addition to answering the research question that motivated the research – gives rise to an entrepreneurial opportunity. Likewise, a high-technology firm may run research facilities (such as the Bell Labs or Xerox’s PARC) that are independent of the company’s targeted development efforts, but whose results open up new entrepreneurial opportunities. These latter kinds of opportunities are arguably created independently of the prior discovery of “higher-order” opportunities. It is by no means necessary, however, that such “serendipitous opportunities” are also *discovered* by their creators. Furthermore, creators of opportunities are not necessarily the only ones able to discover them. (For example, an academic researcher may present her findings at a conference, and a member of the audience then sees an opportunity for commercial application that the researcher herself may be unaware of.) Accordingly, even when opportunities are created by the agent herself, it still makes sense to distinguish between the existence of the opportunity and its discovery, as in Shane’s (2003) linear depiction of the entrepreneurial process.

To illustrate these points, it is helpful to refer to some actual entrepreneurial opportunities. As a first example, consider the improved microscope innovated by the German firm Carl Zeiss around 1870 (for a detailed account, cf. Buenstorf and Murmann, 2005). Carl Zeiss had founded a small workshop that, among other things, produced simple microscopes that he sold to local university researchers. Zeiss was convinced that superior microscopes could be made provided the underlying laws of optics were better understood. He therefore initiated a cooperation with university physicist Ernst Abbe who entered into the firm’s service and developed an analytical theory of the microscope. Based on Abbe’s findings, Zeiss was indeed able to produce vastly improved microscopes, enabling his firm to become Germany’s dominating optics firm by the early 20th century.

In terms of the above discussion, it could be argued that the opportunity for making theory-backed microscopes did not exist before Abbe, on Zeiss’ initiative, developed the theory of the microscope. In this sense, Zeiss deliberately created the opportunity that he subsequently exploited with his firm. However, Zeiss was motivated by the conviction that such an opportunity could be created, which presupposes his discovery of a “higher-order opportunity.” Moreover, since the deficiencies of the available microscopes were well known, any other individual knowledgeable in optical instruments and their manufacturing could have made the same discovery. In this sense, the “higher-order opportunity” preexisted in an objective way.

The invention and innovation of the mountain bike in the early 1970s provides a second illustrative example (cf. Buenstorf, 2003a). The basic design configuration of the mountain bike gradually evolved over several years in a user group setting in Marin County, California. The group engaged in competitive downhill racing activities, initially using what they called “clunkers”: homemade bicycles assembled from a variety of components found mostly in basements and junkyards. Based on bricolage and trial-and-error testing in the races, the key design features of the mountain bike, including frame geometry, derailleur gearshift with thumb shifters, cantilever brakes, straight handlebar, etc., gradually stabilized. Initially, the group members did not pursue any commercial interest, but rather considered themselves part of the hippie subculture. Beginning in 1976, individual group members started lifestyle firms producing frames or assembling bicycles in small numbers. Finally, in 1982, with Mike Sinyard’s Specialized firm, the first successful mass-market mountain bikes were marketed by a producer that had no links to the innovating user group.

How can the mountain bike case be made sense of in terms of the opportunity concept? Clearly, in this case an opportunity for profitable entry was actively created by human behavior. As opposed to the Zeiss example, however, this creation was not driven by the discovery of a “higher-order opportunity.” For years, the members of the innovating user group did not expect their “clunkers” to have any appeal to outsiders. As one of the group members (Kelly, 1979) put it: “This sport may never catch on with the American public, but its originators couldn’t care less.” Moreover, when the potential demand for the new bicycle, i.e., the entrepreneurial opportunity it represented, was eventually discovered, the ability to make the discovery was not limited to the group members, but it was actually an outsider who first pursued the opportunity on a large scale.

In summary, three points regarding the existence of entrepreneurial opportunities emerge from the above discussion. First, opportunities are almost invariably created by human activity, in part by activity outside the market sphere, in part by economic activity within markets. Second, if an opportunity is created by an entrepreneur herself rather than by another agent, this creation may nonetheless be based on the discovery of a “higher-order opportunity” that existed independently of the entrepreneur and that could have been discovered and pursued by others. Third, even if an entrepreneur creates the opportunity herself and is *not* motivated by the discovery of a “higher-order” opportunity, the potential discovery of the newly created opportunity may not be limited to that entrepreneur. Again, in this sense it can be said to exist objectively. Thus, the implication of the present attempt at approaching the opportunity concept from an evolutionary market process perspective is that

no contradiction necessarily exists between the active creation of opportunities and their objective existence (or at least that of “higher-order opportunities”). The next section turns to the links between the perception of opportunities and the ways they are pursued.

4. Entrepreneurial business conceptions and the perception—pursuit nexus

Evolutionary economists have a keen interest in understanding the dynamics of firm organizations, an issue that has received little attention in Austrian economics (Witt, 1999). The dominant evolutionary approach to organizational change was pioneered by Nelson and Winter (1982). Building on the Carnegie school of organization science, these authors characterize firms as governed by organizational routines. Firms are argued to “remember by doing,” with the organizational routines – the firm’s recurring patterns of organizational processes – embodying the firm’s “memory.” Routines, which are typically based on the repeated interaction of several firm members, enable coordinated activity because they make the behavior of firm members mutually predictable. The knowledge reflected in the firm’s routines is frequently tacit in nature; the firm members holding it may be unable to express it verbally. As a consequence, routines are difficult to transfer to new contexts within or outside the firm. For outsiders, they are even harder to imitate. Routines thus add to the heterogeneity of firms.⁶

The emergence of organizational routines, and their relationship to purposeful entrepreneurial activity in the fledgling firm, have long remained unresolved issues. A useful approach to deal with these issues was developed by Witt (1998) in his theory of cognitive leadership. According to Witt, new entrepreneurial ventures are based on a “business conception,” i.e., a subjective interpretation of the entrepreneurial opportunity and of the venture’s basic approach to exploit it. Business conceptions are largely based on intuition and

⁶ Strategy researchers frequently adopt the routine concept from evolutionary economics. In particular, it is congenial to the resource- and capability-based approaches in strategy, where firms are characterized as ongoing, heterogeneous entities whose past activities condition their present competitive position as well as the future developmental trajectories open to them (Peteraf and Barney, 2003). According to this view, the competitive position of the firm is based on its strategic resources and capabilities, i.e. those assets and skills that cannot easily be imitated by competitors. Frequently, the accumulation of strategic resource positions also takes time within the firm, as their rate of adjustment per unit time is limited (Dierickx and Cool, 1989). Organizational routines fit well into this characterization of what firms are and how they develop over time. Given their shared and partially tacit character, routines cannot be developed instantaneously by the firm, and they are difficult to copy for competitors. Organizational routines are thus straightforward as loci of organizational capabilities. In turn, capabilities condition the firm’s capacity to discover and pursue opportunities. Thus, at least in the context of entrepreneurial activities by established firms (“corporate entrepreneurship” in Burgelman’s [1983] sense), the routine concept links evolutionary economics, strategy and entrepreneurship.

tacit knowledge. Conceptually, the notion of business conceptions builds on findings of the cognitive sciences highlighting the effects of past experience, memory and current intentions on how agents perceive situations and what problem-solving approaches they employ (cf. Buenstorf, 2003b, for a survey).

The notion of business conceptions helps establish a number of links that are important in the present context. First, the entrepreneur's subjective perception or "framing" of an opportunity conditions her decision whether to pursue it and, if so, how to pursue it. This implies that the discovery and exploitation of opportunities are inextricably linked. In other words, a perception—pursuit nexus characterizes entrepreneurial ventures – the subjective framing of the opportunity shapes the entrepreneur's interpretation of the firm's objectives and approaches (its "mission"). This argument is in line with both Austrian subjectivism and empirical evidence from the entrepreneurship literature (Shane, 2000).

Second, the framing effects of the subjective entrepreneurial business conception are not limited to the founding stage, but also condition the subsequent development of the entrepreneurial firm. The theory of cognitive leadership suggests that entrepreneurial business conceptions have important coordinative and motivating functions in the firm (Witt, 1998). Successful entrepreneurs are able to share the business conception with their employees. This can be done through verbal communication, but even more importantly through repeated personal interaction. The latter also allows for the diffusion of nonverbal tacit knowledge through observational learning and the imitation of role models. If the entrepreneur is successful in spreading her basic interpretation of the firm's objectives and approaches, she can thus ensure that the activities of individual firm members are consistent with each other and with the firm's overall mission. At the same time, a universally shared and internalized business conception is argued to have a substantial motivational impact. Understanding and identifying with the firm's objectives adds to firm members' intrinsic motivation and helps keep opportunistic behavior in check (*ibid.*).

Third, the business conception is closely related and complementary to the notion of organizational routines: a shared business conception provides meaning to the firm's routines, thus facilitating the coordinated transfer and adaptation of routines within the firm. This helps prevent routines from becoming "routine" in the sense that, while being taken for granted by the firm members, they are essentially decoupled from the firm's objectives. Such a decoupling would compromise the firm's capacity for a coherent decentralized adaptation of routines. In contrast, an internalized business conception enables firm members to deal with novel situations in a way that is consistent with the firm's mission even when no guidance

from higher-level management is available. Given the importance of direct interaction and observational learning for communicating the tacit elements of the business conception, sharing and sustaining it becomes increasingly difficult as the firm grows. Witt (2000) therefore suggests that the extent to which the business conception's role can be sustained and renewed in the growing firm is an important component of entrepreneurial performance.

Fourth, coordination in the firm affects the extent to which employees are able to acquire own entrepreneurial skills. If coordination operates largely through cognitive leadership based on a shared business conception, decisions tend to be made in a largely decentralized way, and individual employees face relatively high levels of responsibility and autonomy in their respective tasks. In essence, they thus perform entrepreneurial decision making functions within their scope of autonomy, which allows them to attain an "entrepreneurial attitude" and refine their judgment and decision making skills. Through this on-the-job learning, employees also acquire the capacity to start their own businesses. These theoretical conjectures are consistent with Monica Higgins' (2005) account of the crucial role that the "Baxter Boys" played in the emergence of the U.S. biotechnology industry. Higgins shows that the leadership of Baxter International, a U.S. manufacturer of medical supplies, instilled an "entrepreneurial career imprint" in its young executives by assigning them to challenging yet largely autonomous jobs. The attitude and skills thus obtained turned Baxter employees into sought after managers for the newly emerging biotechnology industry.

Finally, the ongoing framing effects of a shared business conception also condition the firm's own capacity to discover new entrepreneurial opportunities, which is a prerequisite for diversification through entry into new technologies and markets. Within the organizational context of diversification, the shared business conception is likely to act as a double-edged sword. On the one hand, the interpretative framework provided by the conception may compromise firm members' ability to perceive uncertain environmental changes as opportunities for the firm. On the other hand, it shapes firm members' perception whether newly perceived opportunities are compatible with the firm's overarching objectives and worth pursuing in the firm context, thus helping to preselect among the variety of potential new activities in which the firm could enter.⁷

5. Industry evolution and entrepreneurial opportunities

⁷ If employees discover opportunities that are inconsistent with the business conception and rejected by the firm's leadership, the employees may decide to leave the firm and pursue the opportunity on their own in a spin-off. The spin-off phenomenon will be discussed in more detail in section 6.

The previous section touched upon the changing nature of the developing firm. This section widens the focus and discusses changes over time in product markets and industries, which constitute the competitive environment of the individual (entrepreneurial) firm. The evolution of industries has been among the most prominent objects of research in evolutionary economics in recent years. The work on industry evolution is similar to the Austrian tradition in being interested in the dynamics of competitive market processes. However, its focus is less on the coordination of supply and demand in markets than on the entry, growth, and exit of firms ensuing from market competition, as well as changes in the nature of innovations. The research on industry evolution is particularly useful for entrepreneurship scholars because it has clear-cut implications for the existence as well as the perception and pursuit of opportunities. Nonetheless, entrepreneurship research has only just begun to fully exploit its potential (cf. Sarasvathy et al., 2003, p. 154; Shane, 2003, pp. 129-132).

Not all industries follow the same evolutionary path. The most widespread pattern of development has become known as the “industry life cycle” (Klepper, 1997) in which the number of active firms increases initially, but then starts to decline drastically while the market is still growing – the so-called “shakeout” phenomenon. Distinct developmental phases can be distinguished in the industry life cycle dynamics (ibid.). At first, the market for a new product (defining a new industry) is small. Product designs are simple and in flux, with further development in terms of product innovations being highly unpredictable. A large number of typically small firms produce heterogeneous variants of the product, and the emphasis of producers’ innovative efforts is on product rather than process innovations. In the second phase of the life cycle, market volume is increasing and the basic design of the product stabilizes (a dominant design often emerges). Production processes are becoming increasingly sophisticated, being based on the use of specialized machinery. The shakeout in the number of active firms falls into this growth phase, as the incidence of new entry declines while many of the existing producers exit from the industry. In the third, mature, phase of the industry life cycle, growth rates of aggregate output decline, new entry dries up, and market shares of leading producers tend to stabilize. Product innovation further loses significance in the competitive process relative to process innovation. Eventually, with new substitutes becoming available, the industry may decline altogether, and a new cycle begins in the new industry defined by the substitute.

To account for the regularities of the industry life cycle, Klepper (1996) develops a theoretical model driven by dynamic increasing returns of process R&D. As incumbent firms grow in size and become more efficient, new entry is becoming increasingly difficult, while

firms with little success in the innovation process are leaving the market. This is consistent with the shakeout phenomenon. Furthermore, given a decreasing number of active firms and increasing incentives for process R&D, the shift from product to process innovations is explained in the framework of the Klepper model.

These regularities in the life cycle of shakeout industries have direct implications for the way the quantity and nature of entrepreneurial opportunities changes over time. Early concentration of entry and first mover advantages indicate that there are more and better opportunities early in the industry's history. On the other hand, these early opportunities come with higher uncertainty, as the rate and direction of market growth are harder to predict. The higher degree of uncertainty will deter some potential entrepreneurs contemplating entry into the industry, and likewise potential financiers. The shift toward process innovations over the life cycle is associated with decreasing rates of new entry. This suggests that, in general, the scale-enhancing changes to the production process do not open up opportunities for new entry, which is mostly limited in scale. However, with the increasing use of specialized machinery in the maturing industry, new opportunities in upstream (supplier) markets are created. Similarly, the evolutionary dynamics of an industry may create opportunities in horizontally related and downstream (user) industries. Finally, even the shakeout itself gives rise to entrepreneurial opportunities. For example, vacant plants of failed incumbents may provide the impetus for the formation of some of the later entrants. This kind of "opportunistic" entry can indeed be found, e.g., in the historical U.S. tire industry, where it proved to be little successful, however (Buenstorf and Klepper, 2005a).

As mentioned above, not all industries are well described by the life cycle pattern of shakeout industries. A substantial fraction of industries does not experience a shakeout, but there is sustained entry based on the specialization of firms, which can proceed along different dimensions (Klepper, 1997). Submarkets within the industry are an important dimension of specialization. Empirical evidence suggests that specialization along submarkets is feasible in industries where there are no pronounced economies of scope between product variants. A prominent example is the laser industry. There are many different types of lasers, and over the past four decades, progress in laser research has given rise to a stream of new types using different active laser media and technological principles. Most of the individual submarkets for lasers are small in volume. Accordingly, mass production and process innovations are of limited significance in this industry. In contrast, a key challenge for laser producers is to identify useful new applications for lasers and custom-design lasers for these applications. This requires in-depth knowledge of specific customer needs, which is highly application-

specific, limiting the advantages of industry incumbents over newcomers. The importance of market knowledge thus opens up opportunities for new entrants into the laser industry based on familiarity with the respective applications.

Recent empirical work on both the U.S. and the German laser industries (Klepper and Sleeper, 2005; Klepper and Thompson, 2005; Buenstorf, 2005) has shown that in both countries, the emergence of new submarkets has enabled sustained increases in the number of active firms, with new entry having been sufficient to compensate for substantial rates of exit and mergers between active firms. No evidence was found that early entrants enjoyed advantages over later entrants in the laser industry. Accordingly, the opportunities for entrepreneurial entry have not diminished over time in this industry.

The crucial implication of the specialization patterns found in industries such as lasers (but also other industries, e.g., in software) is that the extent and nature of opportunities in an industry are not only dependent on the age of the industry, but also on fundamental technological and economic characteristics. While this limits our ability to generalize across industries, recent work on industry evolution points toward systematic determinants of the alternative evolutionary paths such as the significance of synergies among submarkets. This work promises to yield important insights also for entrepreneurship research.

6. Pre-entry experience and the pursuit of opportunities

Who discovers and pursues entrepreneurial opportunities? Are there systematic differences in the quality of opportunities pursued by entrepreneurs with different backgrounds? These questions cannot be answered conclusively at this time, but recent findings on industry evolution indicate remarkable patterns.

The decision to start a firm appears to be strongly affected by pre-entry experience. Examining the geography of firm origination and entry into the historical U.S. tire industry, Buenstorf and Klepper (2005b) find that regional patterns of firm origination reflected the distribution of potential founders with adequate backgrounds. In particular, spin-offs originated where incumbent firms were located, while other startups primarily originated in more populated regions. There is little evidence suggesting that either agglomeration economies or local demonstration effects shaped the regional patterns of firm origination. In other words, it appears that in the tire industry the decision to start a firm was largely independent of the prospects of profitable local entry, even though the majority of firms did

enter locally (i.e., they located their production facilities in the region where the founders resided rather than entering at another location).

Effects of pre-entry experience moreover show in the growing evidence for superior success of diversifying entrants from related industries vis-à-vis *de novo*, entrepreneurial entrants. A historical example is the U.S. television receiver industry, which was dominated by diversifying radio producers (Klepper and Simons, 2000). Similar evidence was found for the U.S. shipbuilding (Thompson, 2005) and farm tractor (Buenstorf, 2006) industries, as well as for U.S. census data spanning a broad range of industries (Dunne et al., 1988).

In the industry studies, it is possible to distinguish diversifiers according to the specific backgrounds they brought to the newly entered industry. Among the diversifiers in the U.S. farm tractor industry (where entry peaked around 1920), survival analyses indicate that firms with a background in agricultural implements (including John Deere and International Harvester) were the most successful group of entrants. Besides the diversifying implement makers, only prior engine producers performed systematically better than startups, but automobile and truck producers did not (Buenstorf, 2006). This is puzzling since tractors and automobiles (as well as trucks) were closely related technologically in the early 20th century, suggesting substantial economies of scope between both markets. (There even existed conversion kits to use automobiles as tractors.) Moreover, even though the engine is the most complex component of a tractor, and experience in engine production is suggestive of technological capabilities, implement makers performed better than engine producers.

These findings suggest that the performance differences among tractor producers may not primarily have been caused by technological capabilities. We moreover know that agricultural implement makers had extensive networks of marketing outlets throughout the rural U.S. (Williams, 1987). Their decisive competitive advantage may have been a superior access to customers, providing them with better information about customer needs and thus enabling them to introduce commercially successful product innovations. Success in the tractor industry apparently depended to a substantial extent on the capacity to gauge the market, which is closely related to opportunity discovery. Moreover, at least in this particular industry, diversifiers seem to have had superior skills in detecting opportunities as compared to entrepreneurial *de novo* entrants.

Performance effects of pre-entry experience are not limited to preexisting diversifiers, but can also be found within the group of new entrepreneurial ventures. In particular, strong evidence from a number of industries suggests that, on average, spin-offs founded by ex-employees of industry incumbents are particularly successful. Industries with highly

successful spin-offs include historical cases such as automobiles (Klepper, 2002) and tires (Buenstorf and Klepper, 2005a), but also modern high-tech industries such as semiconductors (Moore and Davis, 2004), disk drives (Agarwal et al., 2004), and lasers (Klepper and Sleeper, 2005; Buenstorf, 2005). The available evidence also suggests that not all spin-offs perform equally well, but the top performers are concentrated among the spin-offs of leading incumbent firms. Better incumbents moreover tend to have more spin-offs than other firms. These patterns suggest that spin-off founders learn valuable lessons during their prior employment and are able to transfer their knowledge to the new firm.⁸

It is more difficult to pin down precisely what it is that nascent spin-off founders learn in their jobs, and why it cannot in the same way be exploited in the existing firm, or in a firm that hires employees from leading incumbents (but is not founded by them). Anecdotal evidence suggests that spin-off formation is often based on the pursuit of an opportunity that the employer does not recognize as valuable, or that is not pursued by the employer because it does not fit into the general strategy and/or threatens to cannibalize existing products. (SAP is a classic case in point; Klepper and Sleeper, 2005, provide a theoretical explanation.) This is also consistent with findings that spin-offs are important in industries (such as lasers) that are characterized by specialization along submarkets. At the same time, the above discussion of subjective business conceptions in entrepreneurial firms suggests a direct link between the perception of entrepreneurial opportunities and their subsequent pursuit. Based on these considerations, it is not surprising that spin-offs can exploit opportunities in ways that non-spin-off firms hiring employees from the industry leaders cannot, as spin-off founders are in a unique position to shape the mission and strategy of their firms.

7. Conclusions: evolutionary thought as an opportunity for entrepreneurship research

The general theme of this paper has been to show how the growing body of research in evolutionary economics is able to inform entrepreneurship research. The paper suggests that both theoretical concepts and empirical evidence from evolutionary economics have the potential to add to various aspects of our understanding of entrepreneurship.

⁸ These considerations primarily apply to what may, in analogy to a similar distinction made in the entrepreneurship literature, be called “opportunity spin-offs”: employee startups based on a perceived opportunity for a successful entrepreneurial venture. Empirically, they are often difficult to distinguish from “necessity spin-offs” for which (mostly adverse) developments in the parent firm such as acquisition, withdrawal from a market etc. provided the impetus.

One of these aspects regards the nature of entrepreneurial opportunities, where the above discussion shows that in a market process perspective, almost all opportunities are created by human activity. It makes sense, nonetheless, to see opportunities as existing in an objective way, and to strictly distinguish between the objective existence of opportunities and their subjective perception by the individual discovering them. At the same time, the way in which an entrepreneur perceives an opportunity not only affects her decision whether and how to pursue it. It also has substantial repercussions on the coordination of activities and the motivation of employees in the entrepreneurial firm, thus shaping the latter's subsequent development and possibly – through creating the conditions for spin-off formation by the firm's employees – even further entrepreneurial activities. Finally, the theoretical and empirical research on industry evolution helps identify the changing nature of entrepreneurial opportunities as an industry develops. While there are marked differences in the evolutionary paths of specific industries, current research is improving our understanding both of alternative patterns of industry evolution and the causal factors underlying them. Likewise, the growing empirical evidence on the effects of pre-entry experience on firm performance is helpful to understand how individuals and organizations acquire knowledge and transfer it to new firms and industries.

The empirical evidence on industry evolution is complementary to other kinds of empirical material used in entrepreneurship research, which is typically not limited to a narrowly defined industry and thus can hardly account for industry-specific factors. To be sure, when data for broader sectors or entire economies are utilized, dummy variables may be used to control for industry differences. However, caution needs to be applied in interpreting the coefficient estimates of such dummies, as they may reflect either genuine differences between industries or differences in the ages of the industries at the time of investigation. Furthermore, the notion of entry adopted in industry studies differs from the proxies mostly used to measure entrepreneurship. For a firm to be a new entrant into an industry, the firm as such need not be new. In contrast, new firm formation is the dominant proxy of entrepreneurship in most other empirical work, and accordingly the results from the alternative strands of literature are often not directly comparable. However, if entrepreneurship is conceived as the discovery and pursuit of opportunities, then entry into a new industry (even by preexisting firms) seems a valid proxy of entrepreneurship. It may in some uses be an even better proxy than new firm formation.

The concepts and findings of evolutionary economics discussed above clearly have limitations. Theories of firm development and industry evolution are not fully developed, and

our knowledge about the determinants of pre-entry experience effects on firm performance is still sketchy. There is evidence that the success of diversifying firms depends on the similarity between the new industry and their earlier fields of activity, but indicators of similarity are imperfect. Accordingly, it is not entirely clear under what conditions entrepreneurial *de novo* entrants fare better than diversifiers, which is arguably the most interesting issue for entrepreneurship research in this context. Finally, we are only beginning to explore the coevolutionary interaction between changes at the firm level and the evolution of the industry in which a firm is active.

In concluding, it should also be pointed out that, while this paper has highlighted potential lessons for entrepreneurship research from evolutionary economics, this is by no means to suggest that only entrepreneurship scholars can learn from evolutionary economics and not vice versa. For example, detailed case study evidence on the fate of individual entrepreneurial ventures is extremely helpful to inform the evolutionary work on firm and industry development. Furthermore, scholars of entrepreneurship have amassed material about the characteristics of new firms and their founders, and their empirical studies underline the important role of new entrepreneurial ventures in the economic development of regions and entire economies. New firms are likewise central to the emergence of many new product markets. The findings of these studies indicate that entrepreneurship and new firm formation are crucial ingredients in any adequate theory of competition, market processes, and economic development. This is essentially the project that Schumpeter – one of the founding fathers of both evolutionary economics and entrepreneurship research – already pursued in 1911. Present-day evolutionary economists continue to work on the Schumpeterian project. Yet the project has not been fully accomplished, and the more we learn about entrepreneurship, the better the chances that eventually it will be.

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