The endogenous nature of entrepreneurship: How changes in capital structure affect entrepreneurial action

Rögnvaldur J. Saemundsson
University of Iceland
Gothenburg University
Halmstad University
rjs@hi.is

Magnus Holmén
Halmstad University
magnus.holmen@hh.se

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ABSTRACT
Entrepreneurs create and appropriate value by designing a system of interconnected activities that span beyond the individual firms and determine how they do business. Current research focuses on how entrepreneurs design new activity systems but does not focus on how these changes create new entrepreneurial opportunities and for whom. In this paper we ask why some people but not others identify and exploit entrepreneurial opportunities following changes in an activity system. Based on Lachmann’s theory of capital we develop a theoretical framework for analyzing how changes in the structure of activities, or in Lachmann's terms, changes in the capital structure, affect the perceived uncertainty for entrepreneurial action. Using the framework we build eight propositions about how the perceived uncertainty for action varies with the multiple specificity of the new capital resource and the knowledge required for its use and production. The results have implications for our understanding of the endogenous nature of entrepreneurship as envisioned by Lachmann.

1 INTRODUCTION
In his early work Joseph Schumpeter (1934) focused on the role of the entrepreneur in changing the economy from within. He argued that entrepreneurs create new value through innovation by changing the structure of the economy in a fundamental way. Initially, the entrepreneur will be able to appropriate a large share of this value but with time profit will be eroded by imitation. From this follows that an entrepreneur who wants to continue to profit must continue to innovate, suggesting an endogenous process of economic growth and development.

Two important qualifications have been made to Schumpeter’s model based on historical studies of technological innovation (Rosenberg 1976, 1982). First, the innovation process is rarely characterized by instantaneous breakthrough and discontinuity but is typically a time
consuming process composed of many small steps before an invention or an idea becomes commercially viable. Second, what Schumpeter terms as imitation is seldom a mere reproduction but rather includes creative adaptations and improvements on par with the steps that precede it. Seen from this perspective the Schumpeterian process of economic growth and development is a continuous and evolutionary process where entrepreneurial action will change the structure of the economy, and these changes will in turn create new opportunities for entrepreneurial action (Buenstorf 2007).

Traditionally, entrepreneurship research has not focused on the endogenous nature of entrepreneurship. Early on entrepreneurship scholars searched for personal traits that could provide answers to the question who becomes an entrepreneur (cf Brockhaus and Horwitz 1986), but as the results from this search turned out to be inconclusive the attention has shifted towards understanding how the interaction between enterprising individuals and available opportunities triggers and shapes entrepreneurial action, i.e. why, when, and how some people and not others identify and exploit entrepreneurial opportunities (Shane and Venkataraman 2000). This shift has generated a stream of research investigating the nature of entrepreneurial opportunities (Alvarez and Barney 2007; Eckhardt and Shane 2003; Sarason, Dean, and Dillard 2006; Sarasvathy, Drew, Velamuri, and Venkataraman 2003, Short, Ketchen, Shook, and Ierland 2010) and the characteristics of the opportunity process (Ardichvili, Cardozo, and Ray 2003; Barreto 2012; Choi and Shepherd 2004; Dimov 2007; Gaglio 2004; Haynie, Shepherd, and McMullen 2009; Mitchell, Mitchell, and Smith 2008; Shepherd, McMullen, and Jennings 2007).

Recently, a stream of research has become interested in how entrepreneurs create and appropriate value by designing systems of interconnected and interdependent activities that determine how they do business (Zott and Amit 2010; Zott, Amit and Massa 2011). These activity systems span beyond the individual firm and compose complex interconnected
ecosystems (Adner and Kapoor 2010). This research describes how entrepreneurs change the economic structure by designing their activity systems but does not address how these changes create new opportunities for entrepreneurial action and for whom.

The purpose of this paper is to help fill this gap. We ask why some people, but not others, pursue entrepreneurial opportunities following changes in activity systems. We base our analysis on Lachmann’s (1956/1978) theory of capital and Menger’s (1871/1976) original work on goods of different order to connect the development of knowledge, entrepreneurial action and qualitative changes in the capital structure of the economy. We develop a theoretical framework and propose how changes in the structure of activities affect the perceived uncertainty of entrepreneurial action by focusing on the role of complementarities and multiple specificities of new capital resources and the knowledge required to use and produce them. Finally, we conclude our analysis and discuss the implications of our framework for entrepreneurship research.

2 OPPORTUNITIES FOR ENTREPRENEURIAL ACTION

Despite the current focus on the concept of opportunity in entrepreneurship research it is fair to say that there is yet to emerge a consensus on its definition or meaning (Davidsson and Tonelli 2013, Hansen. Shrader, and Monllor 2011, Short et al. 2010). Most researchers agree about the importance of considering the nexus between enterprising individuals and situations in their environment for understanding entrepreneurial action, but the concept of opportunity has been used both as a reference to situations as objective reality external to the entrepreneur (Eckhardt and Shane 2003; Shane and Venkataraman 2000; Venkataraman 1997) as well as her subjective view of them (Ardichvili et al. 2003; Dimov 2011, Sarason et al 2006, Sarasvathy al 2003). This difference also relates to whether opportunities are always profitable (Davidsson and Tonelli 2013) and if they are discovered or created (Alvarez and
Barney 2007). Davidsson and Tonelli (2013) have suggested that due to this confusion the concept of opportunity should be abandoned in favor of the concept of a new venture idea, but Shane (2012) has proposed that a distinction should be made between opportunities as situations existing independent of the entrepreneur and business ideas that are entrepreneurs’ interpretation of them including how they can be exploited. A distinction between opportunities and ideas makes it clear that entrepreneurs act upon their interpretations of the world that may turn out to have little correspondence with reality, which leads to adaptation or failure.

In this paper we make a distinction between situations external to entrepreneurs and their interpretations of them. As Eckhardt and Shane (2003: 336) we define entrepreneurial opportunities as “situations in which new goods, services, raw materials, markets and organizing methods can be introduced through the formation of new means, ends, or means-ends relationships”.

By assuming that opportunities are both technologically and economically feasible we have in this paper a distinctive "taker" perspective. We focus on what individuals are likely to identify and exploit them but are not much concerned with how these opportunities are created or by whom. Thus, the propensity for entrepreneurial action, i.e. who becomes an entrepreneur, depends on how well already existing opportunities match particular individuals or teams of individuals.

But what determines the match between an opportunity and an individual and produces entrepreneurial action? McMullen and Shepherd (2006) argue that the concept of uncertainty plays a key role as uncertainty in the context of action creates doubt that blocks or delays action, i.e. creates barriers to entrepreneurial entry. In their conceptual model of entrepreneurial action they combine two streams of literature that use alternative
conceptualization of uncertainty. First, entrepreneurial action is more likely for those who perceive such action to be less uncertain because they possess the knowledge necessary to both discover and exploit the opportunity in question. Second, entrepreneurial action is more likely for those who are motivated to bear more uncertainty. Taken together, prior knowledge is necessary for a potential entrepreneur to recognize that an external stimulus represents a potential opportunity and is also required for further assessing the technical and economic feasibility of a potential opportunity. Motivation will determine to what degree a person is attentive to such stimulus and determines if its successful exploitation is desirable given the perceived uncertainty.

In this paper we focus on the role of knowledge for entrepreneurial action. While acknowledging the importance of aspiration and motivation we investigate who perceive the lowest uncertainty for entrepreneurial action following a particular environmental change, i.e. who perceive the lowest knowledge barriers to entry. We assume that knowledge and motivation are independent, i.e. that our results hold for a given level of motivation that is sufficient for entrepreneurial action to occur.

### 3 ENTREPRENEURIAL ACTION AND ACTIVITY SYSTEMS

Entrepreneurial action does not take place in a vacuum. Instead it is performed in an already existing structure of interlinked economic activities that are coordinated within firms, through business relationships, and market transactions. These activities require human and material resources including appropriate knowledge, experience and skills (Madhok 2002; Richardson 1972). Furthermore, innovations, which change some aspect of the economic structure, often do not stand alone, which means that to capture value entrepreneurs are dependent on complementary changes within an innovation business ecosystem (Adner and Kapoor 2010). Entrepreneurial action can therefore include the design of a new type of activity system or the
improvement of an existing one. Due to its interconnectivity several adjustments are likely to be needed following any changes in the activity structure, especially following the design of a new type of activity system or a substantial change of an existing one. These adjustments are subsequent opportunities for entrepreneurial action.

A business model is a description of an activity system for doing business. It describes a set of activities, the resources and capabilities needed to perform them, the external actors involved, e.g. customer, suppliers, and partners, and how the activities are performed and organized. The architecture of the activity system describes how value is created in the system, determines what share of the value is appropriated by the focal business, and captures how the focal business is embedded in the overall economic structure (Zott and Amit 2010).

A priori, a business model reflects entrepreneurs' hypotheses about how value can be created and appropriated and can be used as a concept for framing a search and learning for an effective way of doing business (Chesbrough and Rosenbloom 2002, Teece 2010). It signifies a set of choices that need to be made by the entrepreneur that cannot be evaluated or performed without appropriate knowledge and skills. With a focus on action and activities that need to be performed the attention moves away from the idea of knowledge as assets or commodity, towards the idea of knowledge as the ability to leverage resources (Spender 1996). Thus, given appropriate knowledge and experience an individual will be more likely to pursue an entrepreneurial opportunity related to a particular activity system, prescribed by a business model, because she will be better able to leverage the resources used for performing the activities.

Having established our basic assumptions about the nature of entrepreneurial opportunity, entrepreneurial action and what promotes entrepreneurial action in an economy of interconnected activities we now turn to Lachmann's theory of capital and Menger's original
work on goods of different order in order to analyze how a particular change in the structure of economic activities, namely the introduction of new type of capital resource, affects who will pursue subsequent entrepreneurial opportunities.

4 CAPITAL STRUCTURE, KNOWLEDGE, AND ENTREPRENEURIAL ACTION

The concept of a capital structure is a network structure of material means of production (Lachmann 1956/78) and as such it forms an activity structure that is the basis for entrepreneurial action. While some economists strive to homogenize the concept of capital through a common measurement unit (price, interest) in order to make it more suitable for quantitative economic analysis others stress its heterogeneous nature and how it shapes and is shaped by economic activities.

One approach that stresses the heterogeneous nature of capital is the Austrian theory of capital that has its origins in the work of Carl Menger (1871/1976). Menger made a distinction between goods of different order based on how close or distant causal relationship they had with the satisfaction of wants or needs. Goods of the first order were consumer goods that could be “placed in direct causal connection with the satisfaction of human needs.” (Menger 1871/1976: 57, italics added). Central to Menger’s approach was his subjectivist perspective, leading him to stress individual knowledge and awareness of circumstances as being the basis for economic decisions rather than the actual circumstances themselves (Kirzner 1979). The value of consumer goods is therefore based on how well consumers perceive the goods to satisfy their needs, rather than the value of higher order goods, if any, needed for their

1 The Austrian theory of capital is not a homogenous school of ideas. The main difference that is of importance for this paper is to what degree it follows the subjective focus of Menger’s approach and thus includes a role for entrepreneurial action. One stream can be discerned through the works of Böhm-Bawerk, Wicksell, Hicks and later neo-Austrians where the subjective focus is quickly eliminated. The second stream of works by Hayek, Lachmann, von Mises and Kirzner is more adherent to the subjective approach (See Garrison 1990 for an overview of this difference and its early development).
production. Similarly, the value of higher order goods is based on the prospective value of the consumptions goods to whose production they are to be assigned (Menger 1871/1976: 150).

Goods having indirect causal relationship with the satisfaction of human needs are of second, third, or higher order. Complementary goods at higher order can be progressively transformed into goods of lower order until, finally, resulting in the satisfaction of human wants and needs. Goods of higher order thus represent the means of production, including the classical factors of land, labor, and capital, available to satisfy wants or needs. The whole economy is therefore composed of a complex structure of means-ends relationships where the placements of each higher order good is determined from the causal connection between a good and wants and needs, and from existing means of production. There is not a natural, given ranking of the order of any goods in this structure as the ranking is determined solely from a user and a factual production perspective.

Lachmann (1956/1978) develops Menger’s theory of economic progress into a theory of capital structure. He defines capital as "the (heterogeneous) stock of material resources" and argues that capital resources are heterogeneous in use and cannot be combined in an arbitrary fashion. The purposes for which capital resources can be used depend on how they can be combined with other resources and activities. Certain modes of complementarity are technically feasible, but only a subset of them is economically viable. However, the economic significance of a capital resource is dependent on to what degree it is multiple specific, i.e. to what degree it can be used for several different purposes. In other words, multiple specificity reflects the number of complementary uses of a capital resource. For example, a technology platform that is used in a number of different types of products has higher a multiple specificity than a platform used only for a particular type of products. Together, multiple specificity and complementarity provide the order of the capital structure, i.e. how capital
resources and economic activities are structured to meet human needs, and flexibility for change.

The entrepreneur has a very explicit role in Lachmann’s theory (Lachmann 1956/1978: 13-16, 20-24). Entrepreneurs form expectations about the future based on their subjective interpretation of past experience. Expectations are “provisional judgments to be confirmed by later experience, imperfect knowledge capable of being perfected.” (p. 21). They are a part of ongoing process of acquiring knowledge about peoples’ needs and the means to satisfy them in an economical way (p. 24). This ongoing process is reflected by changes in the capital structure, where entrepreneurs may choose to disintegrate existing capital combinations or create new ones based on their knowledge and expectations. Thus, entrepreneurs have creative role in the economy by inducing change and responding to it, as apposed to managers who have an operative role within the existing structure.

Changes that are exogenous to an actor, such as disruptive changes in needs or technology, will make possible or even compel changes in the use of capital resources, which creates opportunities for the actor to take economic advantage of pursuing these changes. However, changes in the capital structure will themselves also create entrepreneurial opportunities by making some capital combinations less likely to be used after such a change, others more attractive, and may even open up for new ones.

The ability to identify, and the willingness to take advantage of, the opportunities that these changes bring is based on the prior knowledge of available entrepreneurs as well as their motivation (McMullen and Shepherd 2006, Shane 2000). This means some individuals are more likely than others to take advantage these opportunities, and furthermore, for some
individuals the likelihood of entrepreneurial action has increased because of the change, whereas for others the likelihood has decreased.²

In other words, the capital structure is an ever-changing structure of means-ends relationships aiming to satisfy human needs. Capital resources are combined in an ordered albeit not a (fully) predictable manner based on the complementarities and multiple specificities of the resources themselves on the one hand, and the expectations, knowledge and actions of entrepreneurs on the other. In this sense the capital structure can be seen as an evolving structure of economic activities where entrepreneurs create, apply and distribute knowledge for leveraging material resources. Over time entrepreneurial action both shapes and is shaped by the capital structure in an endogenous manner where entrepreneurs are both makers and takers of opportunities for value creation and appropriation by creating new activity systems and improving existing ones.

In the next section we spell out how Lachmann’s theory can be used to predict how changes in the activity structure create new entrepreneurial opportunities and for whom. We focus on how potential entrepreneurs are takers of opportunities following a specific change in the capital structure, i.e. who perceive the lowest knowledge barriers to entry following the introduction of a new capital resource.

**5 PURSUING ENTREPRENEURIAL OPPORTUNITIES FOLLOWING CHANGES IN CAPITAL STRUCTURE**

Lachmann’s theory of capital brings together the buildings blocks that are needed for our purposes but there are a number of specific issues that need to be addressed. Most importantly Lachmann (1958/1978) is never very explicit about the relationship between knowledge and

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² When we refer to an entrepreneur it should be taken to mean a single individual or a team of individuals whose knowledge and experience is the basis for identifying and exploiting business opportunities.
the capital structure. Lewin (1996) even argues that while the Austrian economists stress the importance of knowledge they tend to treat is as an exogenous variable never giving much attention to it as a phenomenon. In our case we need to explicitly specify how the complementarities and multiple specificities of capital resources affect the knowledge requirements for their development and use. To remedy this shortcoming we use Menger’s (1871/1976) concept of goods of different order and based on that derive the concept of knowledge of different order.

Menger defined goods having indirect causal relationship with the satisfaction of human needs to be of second, third, or higher order. Further, he saw goods at higher order being progressively transformed into goods of lower order until, finally, resulting in the satisfaction of human needs. As long as these transformations are not being automated they require labor services by individuals who have the knowledge to carry them out. Drawing on this, knowledge can be seen as an attribute of labor services at higher order that are required to produce a good of a lower order. Hence, in the same way that we have goods of different order we have knowledge of different order - knowledge that is required for the progressive transformation of goods of higher order to meet the satisfaction of human needs.

Menger argued that two conditions needed to hold if a good is to have an indirect causal relationship with the satisfaction of needs. First, a command is needed of the complementarity goods of higher order required for producing the good, both in quality and quantity. Second, the qualities and quantities of the good itself have to fit the complementary goods that are needed for its further transformation into a good of first order that directly satisfies human needs. As we are concerned with the creative aspect of entrepreneurship, as opposed to the operative aspect of management, we are more interested in the qualities of goods and how these qualities complement each other rather than the complementary quantities of the goods involved, i.e. how well their demand and supply is balanced.
According to Menger, the qualities of a good relate to the good's role in satisfying human needs, and the prospective value of meeting those needs. The accomplishment of these qualities is based on the complementary goods and labor services used to produce the good\(^3\). This means that not only is command required of the complementary goods of higher order required to produce the good, but also a command of complementary knowledge at the same order. Similarly, the qualities of the good in question have to fit the complementary goods and the complementary knowledge needed for its further transformation into a good of first order that directly satisfies human need.

We can rephrase the above discussion in terms of capital structure and activity systems. Using a good of first order, i.e. a good directly meeting the satisfaction of human need, the production of that good is dependent on activities that make use of complementary capital resources at the second order. To operate the capital resources requires knowledge and in order to leverage the complementarity of the capital resources for producing the good this knowledge also needs to be complementary, i.e. be composed of fields of knowledge that are compatible with each other. This repeats itself for any man-made capital resource used at the second or lower order, i.e. complementary capital resources and complementary knowledge is needed to produce them, giving rise to systems of activities where labor services leverage the complementarity inherent in the capital structure.

Starting from a good of a first order is not the only perspective for viewing the capital structure. Depending on their multiple specificity capital resources can be employed for single or multiple ends. This is both true of specific instances of a resource (e.g. a single instance of a personal computer) and for a specific class of resources (e.g. personal computers in

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\(^3\) Here the concept of production includes both the development of a good and its delivery to a customer. The ability to develop a good is the ability to perceive and specify a delivery process (in some cases including manufacturing) of a good having certain qualities. The ability to deliver is the ability to implement the delivery process repeatedly.
general). Furthermore, there may be alternative combinations of capital resources (activity systems) employed for the same ends. Each of these activity systems needs to be designed, implemented, and further adjusted through entrepreneurial action. The perceived uncertainty of the action, i.e., the propensity to design, implement, and adjust a particular activity system, is dependent on how knowledgeable the entrepreneurs are about leveraging complementary resources within that activity system.

Below we develop a model of the introduction of a capital resource using our framework of goods and knowledge of different order. For simplicity we limit ourselves to activity systems that only produce one class of products or services (goods). Furthermore, we assume that there exists the possibility of making the production of goods more economical by introducing a capital resource that can be used as a substitute for one or more capital resources. We use the model to propose how the potential complementary of the new capital resource affects the perceived uncertainty of two different types of opportunities assuming that the propensity for entrepreneurial action is highest for those who perceive the least uncertainty. A real life example roughly adhering to these assumptions is the introduction of web administration tools in the 90s that will be used as an example to clarify the abstract model (Saemundsson and Holmén 2011).

Let M, N be integers, 2 ≤ M, N. Let CR$_i^N$ be a capital resource at the Nth order and K$_i^N$ be the associated knowledge field needed to leverage the resource for a particular end. Let us assume that before a particular point in time, T, a set of M complementary capital resources and associated knowledge fields at the Nth order (K$_1^N$ CR$_1^N$, K$_2^N$ CR$_2^N$, ..., K$_M^N$ CR$_M^N$) are needed to produce a class of goods of the N-1 order (G$_{N-1}^N$). By a class of goods we mean a category of goods that meet certain ends, but may differ in how well they do so. As N ≥ 2 the goods at the N-1 order may be goods at the first order that directly satisfies human needs or
wants, or of higher order that does so indirectly through its complementary with goods at the same or lower order.

Let us assume that a new capital resource (NCR) at the Nth-order, CR_{M+1}^N, becomes available at time T’, T’>T. The capital resource CR_{M+1}^N can be used to replace the CR_1^N, CR_2^N, ..., CR_j^N, j integer ≥1. This means that when using CR_{M+1}^N to produce G^{N-1} the labor services based on knowledge fields K_1^K, K_2^K, ..., K_j^K are not required. Only services based on K_{j+1}^N, K_{j+2}^N, ..., K_{M+1}^N are required. Furthermore, in order to produce CR_{M+1}^N a set of L complementary capital resources and associated knowledge fields at the N+1th order (K_1^{N+1} CR_1^{N+1}, K_2^{N+1} CR_2^{N+1}, ..., K_L^{N+1} CR_L^{N+1}) are needed. For brevity we will term knowledge fields K_1^K, K_2^K, ..., K_j^K as the abstracted knowledge fields, the knowledge fields K_{j+1}^{N+1}, K_{j+2}^{N+1}, ..., K_M^{N+1} as the non-abstracted knowledge fields, K_{M+1}^{N+1} as the NCR use knowledge field, and K_1^{N+1}, K_2^{N+1}, ..., K_L^{N+1} as the NCR production knowledge fields.\(^4\)

In our example the introduction of web administration software (a new capital resource) offered to replace various programming tools used to make custom-made scripts for database access and display control. The level of computer programming knowledge required for creating and managing web system (abstracted knowledge fields) was greatly reduced by this change and instead knowledge of web administration system was required (NCR use knowledge field). However, the need for knowledge of graphic design (non-abstracted knowledge field) and the tools used for graphic design stayed the same or where adapted to, or integrated with, web administration systems. Finally, the knowledge required for producing

\(^4\) Our notion of abstracted and non-abstracted knowledge fields refers to the potential knowledge substitution that is made possible by the introduction of the new capital resource. The level of knowledge substitution is reflected by the multiple specificity of the NCR use knowledge field and NCR production knowledge fields respectively. As its multiple specificity increases a knowledge field becomes less context specific reflecting a higher degree of knowledge substitution.
web administration software (NCR production knowledge fields) was to a large degree based on computer programming (abstracted knowledge fields).

Two types of opportunities are created by the introduction of a new capital resource. First, there is the opportunity to use the capital resource as new means for existing ends (the primary opportunity). This most clearly applies to the production of $G_{N-1}^N$, but given some multiple specificity, the new capital resource has the potential of being used as a substitute elsewhere in the capital structure. Second, there is the opportunity to pursue new ends (the secondary opportunity). The production of goods in the same class as $CR_{M+1}^N$ is an example of new ends, but the new capital resources may also make it possible to pursue ends that where neither technically or economically feasible before. We now look at each of these opportunities and investigate how the perception of uncertainty is influenced by the complementary of the new capital resource. First, we need to clarify what we mean by complementary and how multiple specificity explains flexibility in complementarity.

Complementarity of capital resources is a property of means that are used jointly for the same ends (Lachmann 1977: 200). One aspect of complementarity is the physical compatibility of the material resources, e.g. the staples have fit the stapler and the computer has to be connected to the printer. Another aspect of complementarity is the compatibility and consistency of the associated knowledge, i.e. the knowledge needed to use the resources in the way that they complement each other to achieve the expected ends. For example, in the case of an advertisement designed for publication in an exclusive high quality printed magazine the graphic designer using specialized software for the design needs to take into account that the design has to be color printed in high resolution. It is not enough that the computer and the printer can be physically connected, and that the software is able to generate the physical, high resolution output, but the graphic designer needs to have the knowledge necessary to generate an output that meets expectations.
The multiple specificity of a capital resource implies that the resource can be used, up to a certain limit, for different ends and be combined with different capital resources (Lachmann 1978:2), including the ease with which a capital resource can replace other resources used for specific ends. The level of multiple specificity is determined by how compatible the resource is with other resources as this compatibility determines the range of resources it can be combined with. A resource that uses a standardized interface, e.g. a computer that has USB and Ethernet ports for communication with peripherals, has a higher level of multiple specificity compared to a computer that uses a proprietary means to connect with peripherals, which makes its complementarity with other resources more flexible. However, for our purposes it is important to make a distinction between the multiple specificity of a capital resource itself and the multiple specificity of the knowledge that is needed to use it in combination with other resources or to produce it. Even if the physical characteristics of a capital resource are the same, different knowledge may be required to use it depending on how it is combined with other resources and for what ends the resource combinations are used. Furthermore, the knowledge needed to use a resource for certain ends may be different from the knowledge that is needed to produce it. For example, the knowledge required to use a word processor to write computer programs that are transformed into machine code using a compiler is different than the knowledge needed to use a word processor to write a sales letter and print it using a printer. In both cases the same capital resource is being used, i.e. the word processor, but in combination with different resources and for widely different ends, and thus requiring different knowledge. In the former case similar knowledge is needed for both using and producing the word processor, namely computer programming, but in the latter case the knowledge for production and use is different.

In Lachmann's theory complementarity and multiple specificity of capital resources account for stability and flexibility of the capital structure respectively. If a particular resource
combination is used for new ends, or if the combination of resources employed for some ends is changed, complementarities will change and, given the level of change, may require adjustments both in terms of physical compatibility and knowledge. These adjustments can be anticipated using prior knowledge and experiences, but such expectations are based on "imperfect knowledge to be tested and improved by later experience" (Lachmann 1978: 23). This means that identifying the need, or opportunity, for adjustment is dependent on prior knowledge and experience. It also means that adapting to a change takes time and learning. Finally, it means that failures are possible. Thus, changes in the capital structure create uncertainty, but how this uncertainty is perceived depends on prior knowledge and experience.

Figure 1. Model of the introduction of new capital resource (NCR) at time T'. $G_i$: good at level i; $CR_j$: capital resource j at level i; $K_j$: knowledge field j at level i. Complementary capital resources and knowledge are used to produce goods or capital resources. The notation $N'$ refers to arbitrary level in the hierarchy of goods, i.e. the new capital resource can be used at other levels than level N. The good $G^{N-1}$ refers to both existing and new ends and represents both primary and secondary opportunities. The capital resources $CR_{M+1}^N$ and $CR_{P+1}^{N'}$ refer both to the same capital resource (the NCR), but being used in different contexts. The labels abstracted, non-abstracted, NCR use, NCR production, and use of complementary resources refer to specific sets of knowledge fields that are explained in the text.
Going back to our model (Figure 1) we find that in the case of the primary opportunity the combination of capital resources have changed leading to new complementarities and uncertainties about the knowledge needed for employing the new resource combination for the same ends as before. In the case of the secondary opportunity new ends can be pursued through new types of goods, e.g. the production of a new class of capital resource, and one can expect that the complementarities between the capital resources needed for the goods' production are not fully established and the knowledge for employing the resource combination for that particular ends is still imperfect. We argue that the perception of uncertainty for each of these opportunities is dependent on the multiple specificity of the new capital resource. Furthermore, we argue that it is important to make a distinction between the multiple specificity of the capital resource itself and the multiple specificity of the knowledge needed for its use and production. In the following we propose for whom the perceived uncertainty is the lowest under conditions of low or high multiple specificity. We start with the case when the new capital resource itself has low multiple specificity and make a distinction between low and high multiple specificity of the knowledge required to use and produce the resource, respectively.

**The multiple specificity of the new capital resource is low**

When the multiple specificity of the new capital resource (NCR) itself is low it means that its flexibility for use is low, both with regards the resource combinations it can enter into and the ends it can be employed for. Thus, going back to our model, the primary opportunity is limited to the production of $G^{N-1}$ and secondary opportunity to the production of the new capital resource itself ($CR_{M+1}^N$).

When the multiple specificity of the knowledge needed to use the new capital resource ($K_{M+1}^N$, NCR use knowledge field) is low it means that the NCR use knowledge field is very
context specific, and therefore very close to the abstracted knowledge fields that it replaces. In the extreme the NCR use knowledge field cannot be considered as a new field, but rather coincides with the abstracted knowledge field. In this case those entrepreneurs that have prior knowledge within both the abstracted knowledge fields and the non-abstracted knowledge fields are likely to perceive the least uncertainty related to pursuing the primary opportunity, leading to our first proposition:

**Proposition 1:** When the multiple specificity of the NCR and the multiple specificity of the NCR use knowledge field are low, entrepreneurs having prior knowledge within the non-abstracted knowledge fields and the abstracted knowledge fields perceive the least uncertainty related to pursuing the primary opportunity.

Similarly, when the multiple specificity of the knowledge needed to produce the new capital resource ($K_{1}^{N+1}$, $K_{2}^{N+1}$, … $K_{L}^{N}$, NCR production knowledge fields) is low the NCR production knowledge fields are also very close to the abstracted knowledge fields. In this case entrepreneurs that have prior knowledge within the abstracted knowledge fields will perceive the least uncertainty related to pursuing the secondary opportunity, leading to our second proposition.

**Proposition 2:** When the multiple specificity of the NCR and the multiple specificity of the NCR production knowledge are low, entrepreneurs having prior knowledge within the abstracted knowledge fields perceive the least uncertainty related to pursuing the secondary opportunity.

When the multiple specificity of the knowledge needed to use the new capital resource ($K_{M+1}^{N}$, NCR use knowledge field) is high it means that the NCR use knowledge field is flexible, in the sense that it not dependent on the knowledge it replaces and can be easily be used in combination with other knowledge fields. In the extreme the NCR use knowledge field is fully independent from the abstracted knowledge field. Given that the NCR use
knowledge field is independent from the abstracted knowledge field, and that the NCR use knowledge field, as a new field, is influenced from its complementary use with the non-abstracted knowledge fields, we predict that those entrepreneurs that have prior knowledge within non-abstracted knowledge fields are likely to perceive the least uncertainty related to pursuing the primary opportunity, leading to our third proposition:

*Proposition 3:* When the multiple specificity of the NCR is low and the multiple specificity of the NCR use knowledge field is high, entrepreneurs having prior knowledge within the non-abstracted knowledge fields perceive the least uncertainty related to pursuing the primary opportunity.

Similarly, when the multiple specificity of the knowledge needed to produce the new capital resource ($K_{1}^{N+1}$, $K_{2}^{N+1}$, … $K_{L}^{N}$, NCR production knowledge fields) is high the NCR production knowledge fields become independent to the abstracted knowledge fields. This means that the knowledge on which the new capital good is based is independent of the knowledge that it replaces, i.e. the abstracted knowledge. However, because the NCR use knowledge fields and the non-abstracted knowledge fields need to be complementary, entrepreneurs that have prior knowledge within the non-abstracted knowledge fields and the NCR production knowledge fields will perceive the least uncertainty related to pursuing the secondary opportunity, leading to our fourth proposition.

*Proposition 4:* When the multiple specificity of the NCR is low and the multiple specificity of the NCR production knowledge is high, entrepreneurs having prior knowledge within the non-abstracted knowledge fields and the NCR production knowledge fields perceive the least uncertainty related to pursuing the secondary opportunity.

**The multiple specificity of the new capital resource is high**

When the multiple specificity of the new capital resource (NCR) itself is high it means that its flexibility for use is high, both with regards the resource combinations it can enter into and
the ends it can be employed for. Thus, going back to our model, the primary opportunity is not limited to the production of $G^{N-1}$ but includes the possibility of being employed for other existing ends, and secondary opportunity is not limited to the production of the new capital resource itself ($CR_{M+1}^N$) but includes the possibility of being employed for new ends that where previously either not technically or economically feasible. In both cases, the primary and secondary opportunities turn into multiple types of opportunities each, only limited by the multiple specificity of the new capital resource itself.

As before, when the multiple specificity of the NCR use knowledge field is low the NCR use knowledge fields coincides with the abstracted knowledge field. In this case those entrepreneurs that have prior knowledge the abstracted knowledge fields in combination with knowledge fields related to capital resources that are complementary to the NCR for given ends (including, but not limited to, the non-abstracted fields) are likely to perceive the least uncertainty related to pursuing the primary opportunity, leading to our fifth proposition:

*Proposition 5:* When the multiple specificity of the NCR is high and the multiple specificity of the NCR use knowledge field are low, entrepreneurs having prior knowledge within the abstracted knowledge fields, and use knowledge fields related to capital resources that are complementary to the NCR, perceive the least uncertainty related to pursuing the primary opportunity.

Similarly, as for the NCR use knowledge fields, when the multiple specificity of the NCR production knowledge fields is low the NCR production knowledge fields coincide with the abstracted knowledge fields. In this case entrepreneurs that have prior knowledge within the abstracted knowledge fields will perceive the least uncertainty related to pursuing the secondary opportunity related to the production of NCR. For other secondary opportunities, where the NCR is employed for new ends at other parts of the capital structure, the abstracted knowledge fields needs to be combined with knowledge fields that are related to capital
resources that are complementary to the NCR. Thus, our sixth proposition is split into two parts.

*Proposition 6a:* When the multiple specificity of the NCR is high and the multiple specificity of the NCR production knowledge is low, entrepreneurs having prior knowledge within the abstracted knowledge fields perceive the least uncertainty related to pursuing the secondary opportunity related to the production of the NCR.

*Proposition 6b:* When the multiple specificity of the NCR is high and the multiple specificity of the NCR use knowledge is low, entrepreneurs having prior knowledge within the abstracted knowledge fields, and use knowledge fields related to capital resources that are complementary to the NCR perceive the least uncertainty related to pursuing the secondary opportunity other than the production of the NCR.

As before, when the multiple specificity of the NCR use knowledge field is high, the NCR use knowledge field is fully independent from the abstracted knowledge field. The only difference from the case when the multiple specificity of the NCR use knowledge fields was low is that the abstract knowledge field is not needed. Thus, those entrepreneurs that have prior knowledge within knowledge fields related to capital resources that are complementary to the NCR for given ends (including, but not limited to, the non-abstracted fields) are likely to perceive the least uncertainty related to pursuing the primary opportunity, leading to our seventh proposition:

*Proposition 7:* When the multiple specificity of the NCR is high and the multiple specificity of the NCR use knowledge field is high, entrepreneurs having prior knowledge within use knowledge fields related to capital resources that are complementary to the NCR perceive the least uncertainty related to pursuing the primary opportunity.

As before, when the multiple specificity of the NCR production knowledge fields is high it becomes independent to the abstracted knowledge fields and entrepreneurs that have prior knowledge within the non-abstracted knowledge fields and the NCR production knowledge
fields will perceive the least uncertainty related to pursuing the secondary opportunity related to the production of NCR. For other secondary opportunities, where the NCR is employed for new ends at other parts of the capital structure, the knowledge fields that are related to capital resources that are complementary to the NCR do not need to be combined with the abstracted knowledge fields. Thus, our eight, and final, proposition is split into two parts.

*Proposition 8a:* When the multiple specificity of the NCR is high and the multiple specificity of the NCR production knowledge is high, entrepreneurs having prior knowledge within the non-abstracted knowledge fields and the NCR production knowledge fields perceive the least uncertainty related to pursuing the secondary opportunity related to the production of the NCR.

*Proposition 8b:* When the multiple specificity of the NCR is high and the multiple specificity of the NCR use knowledge is low, entrepreneurs having prior knowledge within use knowledge fields related to capital resources that are complementary to the NCR perceive the least uncertainty related to pursuing the secondary opportunity other than the production of the NCR.

Table 1 and 2 summarize our propositions for the influence of variations in multiple specificity of the new capital resource, and the knowledge fields necessary to use and produce it, on the perceived uncertainty of the primary and secondary opportunities.

<table>
<thead>
<tr>
<th>Multiple specificity of NCR use knowledge</th>
<th>Multiple specificity of NCR</th>
</tr>
</thead>
<tbody>
<tr>
<td>Low</td>
<td>Low</td>
</tr>
<tr>
<td></td>
<td><em>abstracted and non-abstracted</em> (Proposition 1)</td>
</tr>
<tr>
<td>High</td>
<td>High</td>
</tr>
<tr>
<td></td>
<td><em>abstracted and use of complementary resources</em> (Proposition 5)</td>
</tr>
<tr>
<td></td>
<td><em>non-abstracted</em> (Proposition 3)</td>
</tr>
<tr>
<td></td>
<td><em>use of complementary resources</em> (Proposition 7)</td>
</tr>
</tbody>
</table>

*Table 1.* Prior knowledge (sets of knowledge fields) of entrepreneurs perceiving the least uncertainty related to the primary opportunity under different conditions of multiple specificity.
<table>
<thead>
<tr>
<th>Multiple specificity of NCR production knowledge</th>
<th>Multiple specificity of NCR</th>
<th>Low</th>
<th>High</th>
</tr>
</thead>
</table>
| Low                                           | *abstracted* (Proposition 2) |     | a) *abstracted*  
b) *abstracted and use of complementary resources* (Proposition 6) |
| High                                          | *NCR production* (Proposition 4) |     | a) *NCR production*  
b) *use of complementary resources* (Proposition 8) |

**Table 2.** Prior knowledge of entrepreneurs perceiving the least uncertainty related to the secondary opportunity under different conditions of multiple specificity.

### 6 DISCUSSION AND CONCLUSION

The aim of this paper is to contribute to the understanding of the endogenous nature of entrepreneurship. More precisely, we ask why some people, but not others, pursue entrepreneurial opportunities following changes in an activity system. We use Lachmann’s theory of capital to develop a theoretical framework for analyzing how changes in the structure of activities affects who perceive the least uncertainty for entrepreneurial action.

We use the framework to develop eight propositions about for whom entrepreneurial opportunities are created following the introduction of a new capital resource. We can interpret the change as an opportunity for a new business model built around a new combination of capital resources used for given ends. This business model could be pursued by a separate activity system (a start-up) or be pursued in combination with other business models in an existing activity system (a firm). The ability to recognize this opportunity and to have low perceived uncertainty in pursing it is based on particular knowledge fields and those individuals, or team of individuals, that are endowed with these knowledge fields have lower knowledge barriers to entry and thus higher propensity for entrepreneurial action.
Furthermore, the change augments the economic activity structure by providing opportunities for a new business model around new ends, including the production of the new capital resource itself. This capital resource may initially be intended only for the ends it was built, but later on its multiple specificity can increase, i.e. it can be used for a number of different ends. Also, the new capital resource may have been developed for other ends already and its introduction into the specific context investigated one example of its multiple specificity. In any case, the secondary opportunity and its possible interconnectivity to other elements in the economic structure illustrates the endogenous nature of entrepreneurial opportunities.

In this paper we have laid some groundwork for understanding how entrepreneurial activity is shaping and is shaped by changes in the economic structure. We encourage further development of our framework and empirical studies that investigate how changes in activity systems create new opportunities and for whom. We also believe our approach is not only helpful for understanding entrepreneurial action where entrepreneurs are takers of opportunities, but also action where entrepreneurs are makers of opportunities.

We argue that more research along these lines is important for entrepreneurship research for several reasons. First, it may be able to better predict Schumpeterian swarming following changes in an activity system, i.e. the rate and direction of imitation following an innovation (Schumpeter 1934). Not only is this phenomenon of interest for researchers and policy makers, but also for entrepreneurs as designers of new business models (Zott and Amit 2010), who are interested in the competitive advantage of the focal firm, and business managers who want to remove bottlenecks their innovation ecosystems (Adner and Kapoor 2009). Second, as our approach is based on the general notion of goods and knowledge of higher order we believe it has a very general applicability in terms of activity system changes. To date we have used it for empirically studying the effects of the introduction of new software tools (Saemundsson and Holmén 2011) but we believe it can be extended to include other kinds of
capital resources, both tangible and intangible, such as platform technologies, manufacturing methods, and business development methods.
REFERENCES


