Chapter 20
The Impact of Entrepreneurship on Economic Growth

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Introduction

Since the late 1980s, we have witnessed many studies examining the consequences of entrepreneurship in terms of economic performance. This literature is generally restricted to two units of observation – that of the firm (or establishment) and that of the region. It is clear that an increased economic performance by firms and regions will positively affect aggregated economic growth at the country level. A sizeable body of literature analyzing the impact of entrepreneurship on economic performance at the level of the firm (or establishment) emerged. These studies typically measure economic performance in terms of firm growth and survival (Audretsch, 1995; Caves, 1998; Davidsson et al., 2006; Sutton, 1997). The compelling stylized fact emerging from this literature is that entrepreneurial activity, measured in terms of firm size and age, is positively related to growth.[1] New and (very) small firms grow, on average, systematically larger than large and established incumbents. These findings hold across Western economies and across time periods. The link between entrepreneurship and performance is also extended beyond the firm as unit of observation to focus on geographic regions. A small body of literature developed linking measures of entrepreneurial activity for regions to the economic performance of those regions (Acs & Armington, 2004; Audretsch & Fritsch, 2002).

Studies considering the impact of entrepreneurship on performance where the country is the unit of observation are notably scarce, despite the efforts of the Global Entrepreneurship Monitor (GEM) research program (Reynolds et al., 2005). The

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[1] See Audretsch et al. (2004) and Santarelli et al. (2006) for a survey of studies dealing with (violations of) Gibrat's Law.

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purpose of this chapter is to provide a survey of what is known about the links between entrepreneurial activity and (macro)economic growth. Notwithstanding the numerous claims made linking entrepreneurship to subsequent economic growth, the relative void here may be attributable to a paucity of theoretical frameworks linking entrepreneurship to growth as well as severe constraints in measuring entrepreneurship in a cross-national context. The reversed causality of economic development as it influences entrepreneurial activities is a further challenge. In this chapter, we provide overviews of the relevant literature and complement them with some new material.[2] We concentrate on economically developed economies (OECD countries) and do not discuss the (sizeable presence of) self-employment in the agricultural sector.

Explanations for economic growth have generally been restricted to the realm of macro-economics (Krugman, 1991; Lucas, 1988; Romer, 1990). However, a different scholarly tradition linking growth to industrial organization dates back at least to Schumpeter (1934). According to this tradition, performance, measured in terms of economic growth, is shaped by whether or not the industry structure utilizes scarce resources as efficiently as possible. This (most efficient) industrial structure does not alter if its underlying determinants are stable. However, as Chandler (1990), Scherer and Ross (1990) and Dosi (1988) emphasize, a change in the underlying determinants would be expected to result in a change in the industry structure most conducive to growth. Certainly, Chandler (1990) and Scherer and Ross (1990) identified a shift in industry structure toward increased centralization and concentration throughout the first two thirds of the previous century as a result of changes in the underlying technology, along with other factors.

More recently, it appears that technological change, globalization, deregulation, shifts in the labor supply, variety in demand, and resulting higher levels of uncertainty have shifted industry structure away from greater concentration and centralization and toward lesser concentration and decentralization (Thurik, 2009). A series of empirical studies find two systematic responses in the industry structure to the changes in the underlying determinants. The *first* is that the industry structure is generally shifting toward an increased role for small firms. The *second* is that the extent and timing of this shift varies across countries. Apparently, institutions and policies in select countries facilitate a greater and more rapid response to technological change and globalization, along with the other underlying factors, by shifting to a less centralized and more dispersed industry structure than is present in other

[2]Other recent overviews of the literature include Audretsch et al. (2006) and Braunerhjelm (2008), focusing on the key role of entrepreneurs (who benefit from knowledge spillovers) in achieving growth. Parker (2009) devotes part of Chapter 11 to a literature survey of entrepreneurship and aggregate growth. In their literature survey of the relative contributions of entrepreneurs, Praag and Versloot (2007) distinguish four measures: employment, innovation, productivity, and individual utility levels. Carree and Thurik (2006) present a collection of seminal articles.

countries. The question of whether countries that have shifted toward a greater role for entrepreneurship enjoy stronger growth is of great importance to policymakers (Audretsch et al., 2007).

Entrepreneurship is "at the heart of national advantage" (Porter, 1990, 125). Concerning the role of entrepreneurship in stimulating economic growth, many links have been discussed. It is of the utmost importance in carrying out innovations and enhancing rivalry. This directs our attention to two related phenomena of the 1980s and 1990s: the resurgence of small businesses and the revival of entrepreneurship. There is ample evidence that economic activity moved away from large firms to small firms in the 1970s and the 1980s. The most impressive and also the most cited development was the employment share of the 500 largest American firms, the so-called Fortune 500. Collectively, these firms accounted for 20% of employment in the United States in 1970; by 1996 this share had dropped to 8.5% (Carlsson, 1992, 1999).

Both Acs and Audretsch (1993) and Carlsson (1992) provide evidence concerning manufacturing industries in countries in varying stages of economic development. Carlsson advances two explanations for the shift toward smallness. The *first* deals with fundamental changes in the world economy from the 1970s onward. These changes relate to the intensification of global competition, the increase in the degree of uncertainty and the growth of market fragmentation. The *second* deals with changes in the character of technological progress. He shows that flexible automation has various effects, resulting in a shift from large to smaller firms. Also, Piore and Sable (1984) argue that the instability of markets in the 1970s resulted in the demise of mass production and promoted flexible specialization. This fundamental change in the path of technological development led to the occurrence of vast diseconomies of scale.

Brock and Evans (1989) argue that the shift away from large firms is not confined to manufacturing industries. They provide four more reasons why this shift has occurred: (1) the increase in labor supply, leading to lower real wages and coinciding with an increasing level of education; (2) changes in consumer tastes; (3) relaxation of (entry) regulations; and (4) the fact that we are in a period of creative destruction. Loveman and Sengenberger (1991) stress the influence of two trends of industrial restructuring: the formation of new business communities as well as decentralization and vertical disintegration. These intermediate forms of market coordination flourish as a result of declining transaction costs. Furthermore, they emphasize the role of public and private policies in the promotion of the small business sector. Audretsch and Thurik (2000) point to the necessary shift toward knowledge-based economies as the driving force behind the move from large to small businesses. In their view, globalization and technological advancements are the major determinants of this challenge of the Western countries. In Freytag and Thurik (2010) a range of cultural aspects is covered. See also Davidsson (1995).

The causes of this shift are one aspect. Its consequences cover a different area of research. Acs (1992) is among the first to discuss them. He distinguishes four consequences of the increased importance of small firms: entrepreneurship, routes

of innovation, industry dynamics, and job generation. He makes two claims. First, small firms play an important role in the economy by serving as agents of change because of their entrepreneurial activity. Second, small firms are the source of considerable innovative activity, stimulating industry evolution, and creating an important share of new jobs. Acs and Audretsch (1990) and Audretsch (1995) are key references because of their consideration of the role of smallness in the process of innovative activity. See also Cohen and Klepper (1992), who discuss the role of firm size and diversity in technological progress. The role of small firms in the job creation process remains controversial.[3]

The reevaluation of the role of small firms is related to a renewed attention being paid to the role of entrepreneurship in firms. If the size class distribution has an influence on growth, it must be differences in organization that matter. The major difference between the organization of a large firm and that of a small one is the role of ownership and management. In a small firm, usually there is one person (or a very small group of people) in control who shapes the firm and its future. The role of such a person is often described using the term "entrepreneurship." Furthermore, many stress the role of the entrepreneur in implementing innovations.[4] Attention is also given to the more aggregated role of entrepreneurship in economic development, i.e., in the functioning of markets. Many economists and politicians now note the positive impact of entrepreneurship on the growth of GDP and employment. This renewed interest of politicians and economists coincides with a revival of business ownership rates in most Western economies.

The remainder of this chapter is as follows. In Section 2, we will deal with the influence of economic development on entrepreneurship. In Section 3, types of entrepreneurship and their relation to economic growth are discussed. The effect of the choice between entrepreneurship and employment is covered in Section 4. Section 5 considers with entrepreneurship in endogenous growth models. Section 6 discusses empirical evidence. The topic of Section 7 is the time lag between entrepreneurial activity and economic performance. This is an important topic, since the impact of entrepreneurship on economic growth is unlikely to be instantaneous. Section 8 concludes. The general emphasis will be on the role of entrepreneurship for economic development at the macro-economic level. Readers not interested in the sometimes rigorous approach of the economic sciences can skip the mathematical expositions of sections 3, 4, and 5.

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[3] See Carree and Klomp (1996) and Davis et al. (1996) for further discussion.

[4] This has led to the knowledge spillover theory approaches (Audretsch, 2007; Audretsch & Keilbach, 2008; Audretsch et al., 2006) which are dealt with elsewhere in this *Handbook of Entrepreneurship Research*. Entrepreneurship can contribute to growth by serving as a mechanism to help knowledge spilling over or to permeate the filter which impedes this spillover. The knowledge spillover theory attributes importance not just to the role of persons but also to that of regional agglomerations of knowledge activities (entrepreneurship capital) which then become the breeding ground of growth.

The Influence of Economic Development on Entrepreneurship

In this section, we discuss how business ownership rates are influenced by economic development.[5] We pay attention to the role that the "Schumpeterian regime switch" played in this relationship. We discuss the pre-1970s era of declining business ownership rates and the period thereafter, in which the rates rose in most Western economies. The emphasis of the succeeding sections will be on how the business ownership rate at the economy-wide level influences the extent of structural transformation and subsequent economic growth.

Joseph Schumpeter's contribution to our understanding of the mechanisms of technological progress and economic development is widely recognized. In *The Theory of Economic Development* (1934), he emphasizes the role of the entrepreneur as prime cause of economic development. He describes how the innovating entrepreneur challenges incumbent firms by introducing new inventions that make current technologies and products obsolete. This process of creative destruction is the main characteristic of what has been called the Schumpeter Mark I regime. In *Capitalism, Socialism and Democracy* (1950), Schumpeter focuses on innovative activities of large and established firms. He describes how large firms outperform their smaller counterparts in the innovation and appropriation process through a strong positive feedback loop from innovation to increased R&D activities. This process of creative accumulation is the main characteristic of the Schumpeter Mark II regime.

The extent that either of the Schumpeterian technological regimes prevails in any given time period and industry varies. It may depend upon the nature of knowledge required to innovate, opportunities for appropriability, the degree of scale (dis)economies, the institutional environment, the importance of absorptive capacity, demand variety, etc. Industries experiencing a Schumpeter Mark II regime are likely to develop a concentrated market structure, in contrast to industries in a Schumpeter Mark I regime, where small firms proliferate.

Decline of Business Ownership

The first three quarters of the twentieth century can be described as a period of accumulation. From the Second Industrial Revolution through the 1970s, the large firm share rose in most industries and in the economy as a whole. This was the period of "scale and scope" (Chandler, 1990). It was the era of the hierarchical industrial firm that grew progressively larger by exploiting economies of scale and scope in areas such as production, distribution, marketing, and R&D. The conglomerate merger wave of the late 1960s seemed to further the trend. The period

[5] A full account of the relation between entrepreneurship and economic development and whether and why it would be U-shaped is given in Wennekers et al. (2010).

has the characteristics of a Schumpeter Mark II regime, with a declining small firm presence in most industries. The policies of (European) governments also contributed to this decline by promoting large business. The self-employed proportion of the labor force decreased in most Western countries until the mid-1970s. Several authors (Blau, 1987; Kuznets, 1971; Schultz, 1990; Yamada, 1996) report a negative relationship between economic development and the business ownership (self-employment) rate.[6] After the mid-1970s, this decline ended and even reversed in many Western countries and industries. Many old and large firms lost ground to their small, new, and more entrepreneurial counterparts. This is seen as a regime switch (reversal of the trend) from Schumpeter Mark II to Schumpeter Mark I. Audretsch and Thurik (2001) label this as a regime switch from a managed to an entrepreneurial economy.

Reversal of the Trend

After the mid-1970s, the self-employment rate started to rise in most modern economies. Blau (1987) observes that, while the proportion of self-employed in the nonagricultural US labor force declined during most of the twentieth century, this decline bottomed out in the early 1970s and then rose until at least 1982.[7] Elsewhere business ownership increased in several other countries as well.[8] Audretsch and Thurik (2001) show that the business ownership growth rate was higher in the period 1998–1986 than in the period 1986–1974 for 16 out of 23 OECD countries. Other authors provide evidence of a reversal of the trend toward less self-employment. Acs et al. (1994) report that of 23 OECD countries, 15 experienced an increase in the self-employment rate during the 1970s and the 1980s. They show that the weighted average of the self-employment rate in OECD countries rose slightly, from 8.4% in 1978 to 8.9% in 1987. Audretsch and Thurik (2001) show that this growth accelerates in the 1990s. During this era, large firms started downsizing and restructuring in order to concentrate on "core business." In the meantime, the

[6] Some theoretical models propose to explain the decline of self-employment and of small business presence in general. Lucas (1978) shows how rising real wages may raise the opportunity cost of self-employment relative to the return. Given an underlying "managerial" talent distribution this induces marginal entrepreneurs (in this context, Lucas refers to managers) to become employees. This pushes up the average firm size. Iyigun and Owen (1998) develop a model implying that economic development is associated with a decline in the number of entrepreneurs relative to the total number of employees. They argue that fewer individuals are willing to run the risk associated with becoming an entrepreneur as "safe" professional earnings rise with economic development. See also Schaffner (1993).

[7] Other sources showing that the increase in the importance of large businesses has come to a halt in Western countries are Carlsson (1989), Loveman and Sengenberger (1991), Acs and Audretsch (1993), Acs (1996) and Thurik (1999).

[8] The US (non-agricultural) self-employment rate was stable at around 10% for many years. However, in the 2003–2007 period the rate went up in countries like France, Germany, the Netherlands and Sweden. See, e.g., the Compendia data in Carree et al. (2007).

entrepreneur rose from the dead. Innovative high-technology small firms came to the forefront of technological development in many (new) industries.

There are several well-documented reasons for the revival of small business and self-employment in Western economies.[9] *First*, the last quarter of the twentieth century may be seen as a period of creative destruction. Piore and Sabel (1984) use the term "Industrial Divide," Jensen (1993) prefers the term "Third Industrial Revolution," and Freeman and Perez (1988) interpret the period as the transition from the fourth to the fifth Kondratiev wave. The most obvious evidence is the emergence of new industries like software and biotechnology. Small firms play an important role in these new industries. Acs and Audretsch (1987) provide empirical evidence that small firms have a relative innovative advantage over their larger counterparts in such highly innovative industries. Evidence for the comparative advantage of small firms in inventing radical new products is also given in Prusa and Schmitz (1991) and Rothwell (1983, 1984).

Second, new technologies reduced the importance of scale economies in many sectors. Small technology-based firms started to challenge large companies that still had confidence in mass production techniques (Carlsson, 1989; Meredith, 1987). Fiegenbaum and Karnani (1991) show how small firms can benefit from being more "flexible." Jensen argues that "It is far less valuable for people to be in the same geographical location to work together effectively, and this is encouraging smaller, more efficient, entrepreneurial organizing units that cooperate through technology" (Jensen, 1993, 842). This idea is supported by Jovanovic's claim that "recent advances in information technology have made market-based coordination cheaper relative to internal coordination and have partially caused the recent decline in firm size and diversification" (Jovanovic, 1993, 221).

Third, deregulation and privatization movements swept the world. In many Western countries, there are strong tendencies to deregulate and privatize (OECD, 1995, 39–49). Phillips (1985) reports that small firms dominated the creation of new businesses and new jobs in deregulated industry sectors in the United States during the early 1980s.[10] In addition, governments acknowledge and promote the role of small (startup) firms in establishing economic growth and development (OECD, 1998).

Fourth, there is a tendency of large firms to concentrate on their "core competences" (Carlsson, 1989). Jovanovic (1993) reports that, consequently, the 1980s were characterized by corporate spin-offs and divestment. Aiginger and Tichy (1991) blame the opportunistic conglomerate merger wave of the late 1960s for much of the "back-to-basics" and downsizing (or rightsizing) tendencies.

Fifth, increasing incomes and wealth led to an increase in the demand for variety (Jackson, 1984). Cross-cultural influences also increase the demand for variety. Small firms are often the most obvious suppliers of new and specialized products.

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[9] Brock and Evans (1986) were the first to provide a detailed overview.

[10] See Berkowitz and Holland (2001) for the effects of privatization on small enterprise formation in Russia.

The decrease in diversification as reported by Jovanovic (1993) suggests that large firms have not been capable of entering into such market niches.

Sixth, self-employment is more highly valued as an occupational choice than it was previously. Roughly one out of four young US workers pursues self-employment, according to Schiller and Crewson (1997). Kirchhoff (1996) argues that self-employment is no longer perceived as under-employment or as a relic of mom-and-pop establishments but is instead seen as a way to achieve a variety of personal goals.

Finally, the increase in the employment share of the services sector with per capita income is well documented (Inman, 1985). Given the relatively small average size of most services (except for airlines, shipping, and some business and financial services), this creates increased opportunities for business ownership.

Obviously, some of these factors may have only a temporary effect. For example, it is not unlikely that the outsourcing and deregulation waves will dry up. In addition, many of the startups in the newly emerged industries fail to survive (for instance, Internet-based startups from the late 1990s). On the other hand, there are more permanent effects, like the impact of new technologies. We refer again to Freeman and Perez (1988), who claim that in the new techno-economic paradigm (fifth Kondratiev wave), firms will be organized into "networks" of large and small ones. Dushnitsky and Lenox (2005), for example, analyze the role of corporate venture capital programs, where incumbent firms invest in entrepreneurial ventures. Moreover, the introduction of these new technologies is also related to the stage of economic development because the technologies cannot be made effective without the necessary skills and other investments. This structural influence of economic development is reinforced by the increasing variety of demand for specialized goods and services and the enhanced valuation of self-realization, both of which are dependent on the level of prosperity.

Types of Entrepreneurship and Their Relation to Economic Growth

Throughout intellectual history, the entrepreneur has worn many faces and fulfilled many roles (Hébert & Link, 1989). Entrepreneurship has to do with the activities of individual persons. The concept of economic growth is relevant at the levels of firms, regions, industries, and nations. Hence, linking entrepreneurship to economic growth implies linkage between the individual level and the aggregate level. To consider this link, we first consider one definition of "entrepreneurship." Inspired by Hébert and Link (1989), Bull and Willard (1993) and Lumpkin and Dess (1996), the following definition of entrepreneurship can be proposed: Entrepreneurship is the manifest ability and willingness of individuals, on their own, in teams, within and outside existing organizations to perceive and create new economic opportunities (new products, new production methods, new organizational schemes, and new product–market combinations), and to introduce their ideas to the market in

the face of uncertainty and other obstacles by making decisions on location, form and the use of resources and institutions (Wennekers & Thurik, 1999). Essentially, entrepreneurship is a behavioral characteristic of individuals. It should be noted that entrepreneurship is not an occupation and that entrepreneurs are not a well-defined occupational class of persons. Even obvious entrepreneurs may exhibit their entrepreneurship only during a certain phase of their career and/or with reference to a certain part of their activities.[11]

Entrepreneurship is not synonymous with small business. Certainly, small firms are an outstanding vehicle for individuals to channel their entrepreneurial ambitions. The small firm is an extension of the individual in charge (Lumpkin & Dess, 1996, 138). However, entrepreneurship is not restricted to people starting or operating (innovative) small firms. Enterprising individuals in large firms, the so-called "intrapreneurs" or "corporate entrepreneurs," behave entrepreneurially as well. In these environments, there is a tendency to "mimic smallness," for instance, using business units, subsidiaries, or joint ventures.

Because in colloquial speech many terms like "entrepreneur," "self-employed" and "businessmen" are used indiscriminately, their operationalization and measurement are far from obvious. However, one can make some pragmatic distinctions*: first*, between the concepts *entrepreneurial* and *managerial* in the sense of organizing and coordinating; and *second*, between business owners and the *self-employed* (including owner-managers of incorporated firms)[12] and *employees*. Based on this double dichotomy of self-employed versus employee and entrepreneurial versus managerial, three types of entrepreneurs may be distinguished. These three types are the Schumpeterian entrepreneurs, the intrapreneurs and the managerial business owners, those who are entrepreneurs in a formal sense only. This is illustrated in Table 20.1 where executive managers are incorporated as the decisively non-entrepreneurial category.

Table 20.1 Three types of entrepreneurs

	Self-employed	Employees
Entrepreneurial	*Schumpeterian entrepreneurs*	*Intrapreneurs*
Managerial	*Managerial business owners*	Executive managers

Source: Wennekers and Thurik (1999).

[11] See also Gartner (1989, 64) who asserts that "The entrepreneur is not a fixed state of existence, rather entrepreneurship is a role that individuals undertake to create organizations" and Schumpeter (1934, 78) who states that "Because being an entrepreneur is not a profession and as a rule not a lasting condition, entrepreneurs do not form a social class in the technical sense as, for example, landowners or capitalists or workmen do."

[12] The terms "self-employed" and "business owners" will be used interchangeably throughout this chapter.

Schumpeterian entrepreneurs are found mostly in small firms. They own and direct independent firms that are innovative and creatively destroy existing market structures. After realizing their goals, Schumpeterians often develop into managerial business owners, but some may again start new ventures. The latter "serial entrepreneurs" might outperform other entrepreneurs because of their increased human capital, which itself is due to their entrepreneurial experience.[13] Intrapreneurs, the so-called entrepreneurial managers, also belong to the core of entrepreneurship. By taking on commercial initiatives on behalf of their employers, and by risking their time, reputation and sometimes their jobs in doing so, they become the embodiment of leadership, resulting in entrepreneurial ventures in larger firms. Sometimes these entrepreneurial employees, either in teams or on their own, spin-off, start new enterprises ultimately becoming Schumpeterian entrepreneurs. Managerial business owners (entrepreneurs in a formal sense) are to be found in a large majority of small firms. They include many franchisees, shopkeepers, and people in professional occupations. They belong to what Kirchhoff (1994) calls "the economic core" and are the foundation of some of the entrepreneurial ventures.

We focus on three entrepreneurial roles, emphasized by Schumpeter, Kirzner, and Knight, respectively. The *first* is the role of innovator. Schumpeter is the economist who drew the most attention to the "innovating entrepreneur." Such an entrepreneur carries out "new combinations we call enterprise; the individuals whose function it is to carry them out we call entrepreneurs" (Schumpeter, 1934, 74).[14] The *second* is the role of the individual who perceives profit opportunities. We label this role Kirznerian (or neo-Austrian) entrepreneurship (see, for instance, Kirzner, 1997). A *third* is the role of the person who assumes the risk associated with uncertainty. We label this role Knightian entrepreneurship.[15] When an individual introduces a new product or starts a new firm, this can be interpreted as an entrepreneurial act in terms of each of the three types of entrepreneurship. The individual is an innovator, s/he (assumes that s/he) has perceived a hitherto unnoticed profit opportunity and s/he accepts the risk that the product or venture may turn out to be a failure.

There are many definitions of an entrepreneur and of what an entrepreneur does. Based on their study of the history of economic thought about entrepreneurship, Hébert and Link (1989, 47) propose the following: "The entrepreneur is someone who specializes in taking responsibility for and making judgmental decisions that affect the location, form, and the use of goods, resources, or institutions." When one is searching for links between entrepreneurship and growth, this definition is not sufficient. The dynamics of perceiving and creating new economic opportunities and

[13] Metzger (2006) notes that not every experience can be regarded as an indicator of enhanced human capital. The experience of failure can also be an indicator of entrepreneurial incompetence.

[14] Schumpeter's *Theory of Economic Development* was published in German in 1911 and in English in 1934.

[15] The Knightian entrepreneur has also been interpreted as the "neo-classical entrepreneur" (see, for instance, Shane, 2000). In the neo-classical (equilibrium) framework, entrepreneurship is explained by fundamental attributes of people (like the "taste" for uncertainty).

the competitive dimensions of entrepreneurship need more attention. The key contribution of entrepreneurship to economic growth might be singled out as "newness." This includes the startup of new firms but also the transformation of "inventions and ideas into economically viable entities, whether or not, in the course of doing so, they create or operate a firm" (Baumol, 1993, 198).

The management literature has a broad view of entry. In surveying this literature, Lumpkin and Dess (1996) integrate the renewal-oriented aspects of entrepreneurship. "New entry can be accomplished by entering new or established markets with new or existing goods or services. New entry is the act of launching a new venture, either by a start-up firm, through an existing firm or via internal corporate venturing" (Lumpkin & Dess, 1996, 136). In their view, the essential act of entrepreneurship is more than new entry as we see it. Entrepreneurial activity, so-called "new entry" in existing, large firms, often mimics smallness. Newness achieved through the creation of startups and through innovations, as well as through competition, is the most relevant factor linking entrepreneurship to economic growth. While managerial business owners fulfill many useful functions in the economy, such as the organization and coordination of production and distribution, they cannot be viewed as the engine of innovation and creative destruction. This is the major function of Schumpeterian entrepreneurs and intrapreneurs.

In the following model, we give an example of the economic impact of (the lack) of Kirznerian (neo-Austrian) and Knightian entrepreneurship (for the latter, see also Kihlstrom & Laffont, 1979) using the example of the retail sector. A more Schumpeterian approach is presented in Section 5. The model is a simplified version of the carrying capacity model by Carree and Thurik (1999b). The model is used to indicate how a lack of entrepreneurship can affect economic performance. The non-mathematically oriented reader may want to proceed to the last paragraph of this section.

A Model of the Impact of Two Different Types of Entrepreneurship

Assume that there are two local markets, labeled i and j, in which retailers sell a homogeneous good. Retailers can only be in one of the two markets. The total demand by consumers in the two local markets is assumed to have price elasticity equal to unity:

$$Q_x = a_x/p_x \qquad x \in \{i,j\}. \tag{20.1}$$

Each retailer k in market x maximizes profit $\pi_k = (p_x - \beta)q_k - \alpha$ where α are fixed costs and β are variable costs, both of which are identical across firms. Assume that the retailers form a Cournot oligopoly, hence not taking into account reactions by competitors when changing the level of output q_k. Because the cost function of each retailer is assumed to be identical, also the output levels are identical to $q_k = Q_x/N_x$. If there are N_x firms in market x, the equilibrium market price and total output is easily derived as

$$p_x = \beta \frac{N_x}{N_x - 1} \quad \text{and} \quad Q_x = \frac{a_x}{\beta} \frac{N_x - 1}{N_x} \qquad x \in \{i, j\}. \tag{20.2}$$

By inserting this equation into the profit function, we derive that in equilibrium,

$$\pi_k = \frac{\beta Q_x}{N_x(N_x - 1)} - \alpha = \frac{a_x}{N_x^2} - \alpha. \tag{20.3}$$

There is an equilibrium across regions if entrepreneurs in one region earn as much as entrepreneurs in the other region. This implies that

$$\frac{N_i}{N_j} = \sqrt{\frac{a_i}{a_j}}. \tag{20.4}$$

This equilibrium condition assures maximum total output for the two markets combined, given a certain fixed number of entrepreneurs, N. To derive this, note that $N_j = N - N_i$ and that therefore, the sum of outputs is

$$Q_i + Q_j = \left(a_i \frac{N_i - 1}{N_i} + a_j \frac{N - N_i - 1}{N - N_i} \right) / \beta. \tag{20.5}$$

Maximizing Eq. (20.5) with respect to N_i gives us the exact same outcome as given in Eq. (20.4). Now we come to the final issue of how many entrepreneurs there will be. Following Carree and Thurik (1999b), we assume that there exists a critical profit level π^* that entrepreneurs seek to achieve as compensation for their efforts. If profits fall short of the critical level, entrepreneurs will exit until the profit level increases to the critical level. If profits exceed the critical level (new) entrepreneurs will enter until the profit level decreases to the critical level. An important determinant of the critical profit level is the extent to which entrepreneurs want to be compensated for the risk they face.

We give a numerical example to indicate the impact of a lack of either Kirznerian or Knightian entrepreneurship. Assume that the two markets are identical in size, $a_i = a_j = 50$, and that the fixed costs parameter α and critical profit level π^* both equal one. The variable costs parameter β is assumed to be 0.1. The total number of retailers in each of the two markets is then derived from $a_x/N_x^2 - \alpha = \pi^*$ and is found to equal 5 after inserting the numerical values. The total output of the two markets is derived from Eq. (20.2) and is equal to 800.

Now assume that instead of both markets having five firms, that there is one market with six and one market with four firms. Total output then equals 792 instead of the maximum output of 800. Hence, the consequence if at least one of the six retailers is not alert to the prevailing disequilibrium will be an output loss of 1%. The lack of Kirznerian entrepreneurship that would otherwise have alerted one retailer to the

need to change location (market) leads to lower output.[16] Alternatively, assume that entrepreneurs want to achieve (10%) higher compensation for the uncertainty they are confronted with and that the critical profit level π^* equals 1.1 instead of 1. The number of firms is each market then decreases to 4.88, and total output drops to 795. Hence, the consequence of entrepreneurs' being more averse to risk also is a drop in total output. A decrease in the number of individuals prepared to take risks in the marketplace (Knightian entrepreneurs) leads to an output loss.[17] The next section elaborates on this issue: choosing between entrepreneurship and employment.

The Effects of the Choice Between Entrepreneurship and Employment

In this section, we present a simple model of occupational choice in which the impact of entrepreneurial activities is analyzed by considering the consequence of not allowing firms to enter (or exit) or that of not allowing firms to expand (or limit) their activities. We distinguish between three possible economic "systems" labeled "market economy," "semi-planned economy," and "planned economy." Before presenting the details of the occupational choice model, we first discuss important papers that consider the intertemporal relation between occupational choice and economic development.

We briefly discuss the contributions made by three articles: Banerjee and Newman (1993), Iyigun and Owen (1999), and Lloyd-Ellis and Bernhardt (2000). The papers deal with the complicated issue of the two-way interaction between occupational choice and economic development. On the one hand, both the number of individuals choosing to become self-employed and their entrepreneurial skills affect economic development. On the other hand, the process of development affects returns to occupations. It transforms the nature of risks and the opportunities for innovation.

Banerjee and Newman (1993) develop a model in which the distribution of wealth plays a central role. They argue that occupational decisions are dependent upon the distribution of wealth because of capital market imperfections. The latter imply that poor agents can only choose to work for a wage, while wealthy agents become entrepreneurs. The initial distribution of wealth determines whether in the

[16] Yu (1998) provides an interesting analysis of the importance of Kirznerian (adaptive) entrepreneurship in explaining Hong Kong's economic development. He finds that small Hong Kong firms are usually the first groups to get out of a declining sector and move onto new markets. He claims that the diversification of Hong Kong's economy into the service sector "can be explained consistently by the dynamic operations of adaptive entrepreneurship" (pp. 902–903).

[17] Ilmakunnas and Kanniainen (2001) find empirical evidence from OECD countries to support the Knightian view that economic risks shape equilibrium entrepreneurship in an occupational choice model. They find evidence that both "national economic risk" (changes in GDP) and social insurance for labor risks (unemployment compensation), assumed not to be available to the self-employed, negatively impact the self-employment rate.

long run an economy develops to feature only self-employment in small-scale production ("stagnation") or to include an active labor market where both large- and small-scale production prevail ("prosperity"). Banerjee and Newman stress that the model implies the initial existence of a population of dispossessed individuals whose best choice is to work for a wage as the condition needed for an economy to achieve the stage of prosperous capitalism.

While Banerjee and Newman focus on financial requirements as the defining characteristic of entrepreneurship, Iyigun and Owen (1999) focus on the element of risk. They distinguish between two types of human capital: entrepreneurial and professional. Entrepreneurial activities are assumed to be more risky than professional activities.[18] Entrepreneurs in the model accumulate human capital through a work-experience intensive process, whereas professionals' human capital accumulation is education-intensive. The models predict that as technology improves, individuals devote less time to the accumulation of human capital through work-experience and more to the accumulation of human capital through professional training. The allocation of an increasing share of time to formal education continues until a steady state is reached (see Iyigun & Owen, 1999, 224). Hence, entrepreneurs should play a relatively more important role in intermediate-income countries and professionals should be relatively more abundant in rich countries. However, both entrepreneurship and professional activities are important, and those countries that initially have too little of either entrepreneurial or professional human capital may end up in a development trap. Iyigun and Owen point to former communist countries as an example of economies that have a highly educated labor force but that still have not achieved the high-income steady state because of a shortage of entrepreneurs (p. 225).

Lloyd-Ellis and Bernhardt (2000) also derive the scarcity or abundance of entrepreneurial skills as the defining variable behind the equilibrium development process. In their model, individuals may choose between working as entrepreneurs, as wage laborers in industry or in subsistence agriculture. Just as in the Banerjee and Newman model, entrepreneurs are faced with a limited capital market and (inherited) wealth is needed to permit entrepreneurial activity to expand. The economy in the model goes through four separate stages. An interesting outcome of the model is that the average firm size increases quickly in the first stages of the development process but then decreases in the later stages of the development process. The number of entrepreneurs (outside agriculture) as a fraction of the population may rise in each of the stages (Lloyd-Ellis & Bernhardt, 157).

We present a simple model of occupational choice in which the impact of entrepreneurial activities is analyzed by considering the consequence of not allowing firms to enter (or exit) or of not allowing firms to expand (or limit) their activities. We distinguish between three possible economic "systems." In the *first*

[18]The uncertainty in the return to entrepreneurial ventures is that with probability q an individual achieves an income of λ_t, the endogenously determined technology level, times his entrepreneurial capital and with probability 1-q he receives no income. There is no uncertainty assumed in the return to education, being λ_t times their professional capital (see Iyigun & Owen, 1999, 220).

system, labeled "market economy," there is complete freedom of entry and exit, and firms may adjust their inputs to maximize profits. In this system, there is complete entrepreneurial and managerial freedom. In the *second* system, called the "semi-planned economy," there is no freedom of entry or exit. However, firms are free to adjust their input quantities so as to achieve maximum profits. In such an economic system, the large incumbent firms are considered the engines of economic progress. Starting new enterprises is hampered by regulations and by a relatively low level of esteem for business ownership. The *third* economic system, labeled the "planned economy," also does not include the managerial freedom to adjust inputs to maximize profits. Firms are assigned to produce outputs using a certain fixed amount of labor, even though this may lead some firms to become unprofitable.

Clearly, the three economic "systems" are extremes. However, comparing the economic performance of such virtual systems may enhance our understanding of the total contribution of entrepreneurial activity to economic performance in the long and short run. In addition, the conditions in the three systems may approximate actual conditions in existing economic systems. For example, the market economy of the United States grants (potential) entrepreneurs considerable freedom with little government intervention. In contrast, the economies of the nations of Continental Europe, like France, Germany, and the Scandinavian countries, entail a much larger role for government. In these countries, governments have actively intervened to support large enterprises in the recent past. The Soviet Union is the prime example of the planned economy. The model described below is used to compare the relative performance of the three "systems."[19] The non-mathematically interested reader may want to proceed to the last paragraph of this section, in which we discuss the main results.

A Model of Entrepreneurship in Economic "Systems"

Consider a population of N individuals that can choose between being employees and being managers (business owners). Each person i is assigned a certain managerial ability e_{it} in period t. This ability can be used in combination with an input of L_{it} employees earning an equal wage w_t to produce a total output of some (homogeneous) good $Q_{it} = e_{it}L_{it}^{\beta}$ with β in between 0 and 1. Assuming the price of the good to be unity total profit for manager i in period t will be $\pi_{it} = e_{it}L_{it}^{\beta} - w_t L_{it}$. From the first-order condition ($\partial\pi_{it}/\partial L_{it} = 0$), we find the optimal levels of labor input and profit:

$$L_{it}^{*} = (\beta e_{it}/w)^{\frac{1}{1-\beta}} \text{ and} \tag{20.6}$$

$$\pi_{it}^{*} = (1-\beta)e_{it}\,(\beta e_{it}/w)^{\frac{\beta}{1-\beta}}\,. \tag{20.7}$$

[19]The model is only concerned with occupational choice, not with the (dis)incentives present in economic "systems" to pursue product or process innovation.

From Eq. (20.7) it is clear that individuals with higher levels of managerial ability will enjoy higher profits ($\partial \pi_{it}^{*} / \partial e_{it} > 0$). If individuals are free to enter and/or exit, we should see incumbents exiting the market (and becoming employees) if the optimal level of profits is less than the wage level, while employees should start enterprises if the optimal level of profit exceeds the wage level. In conformity with Lucas (1978), equilibrium is reached where individuals become managers if and only if

$$e_{it} \geq \frac{w_t}{\beta^{\beta}(1-\beta)^{1-\beta}}. \tag{20.8}$$

In each of the three economic systems, it is assumed that the wage level is determined by the equilibrium condition that the demand and supply of labor be identical. If we denote the number of managers/entrepreneurs by M_t and their set by Θ_t, then this condition reads

$$N - M_t = \sum_{i \in \Theta_t} L_{it}^{*} \quad \Leftrightarrow \quad w_t = \beta \left(\sum_{i \in \Theta_t} e_{it}^{\frac{1}{1-\beta}} / (N - M_t) \right)^{1-\beta}. \tag{20.9}$$

From Eqs. (20.8) and (20.9), the equilibrium structure, given free entry and exit, can be determined. Given the distribution of the abilities e_{it}, the equilibrium occupational choice and (maximum) total output can be derived. If changes occur in the ability distribution, the manner in which equilibrium in the labor market is restored differs across the economic systems. In the case of a "market economy" system, managers with increased abilities will enter and those with decreased abilities will exit, along with changes in firm size and wage level. In the "semi-planned economy" system, there will be changes in the size of incumbents firms and in the wage level. The one variable that restores equilibrium in the "planned economy" system is the wage level; this is because of the absence of managerial discretion to adapt labor demand. It is obvious that due to the larger "degrees of freedom," the total output after changes in the ability distribution will be highest for the "market economy" and smallest for the "planned economy." The more that the ability distribution changes over time, the larger the differences in performance will be. Hence, in periods of important changes in technological regimes and in the longer term, the differences are likely to be largest. This finding is related to that presented by Eliasson (1995), expressing that lack of new entry of firms will adversely impact economic performance more in the long term than in the short term.

Entrepreneurship in Endogenous Growth Models

One reason that entrepreneurship disappeared from economic theory is that it played no role in the neoclassical growth model developed by Solow (1970). An important characteristic of this growth model is that technological improvements are

exogenous and therefore independent of economic incentives. Economic growth in the traditional growth models is achieved by capital accumulation and exogenous technological progress, both of which leave little room for any entrepreneurial role whatsoever (see also Baumol, 1968). The more recently developed endogenous growth models also support the idea that improvements in technology have been the key force behind perpetually rising standards of living. However, this long-term growth process is assumed in many endogenous growth models to be determined by purposive, profit-seeking investment in knowledge (Grossman & Helpman, 1994, 24). The act of seeking profits by shifting resources to achieve improvements in technology can be seen as entrepreneurial because the outcome of the investments is uncertain. However, it is uncommon for endogenous growth models to explicitly address the issue of entrepreneurship as a driving force of technological and economic development. We will discuss four exceptions in this section.[20] The *first* exception is the Aghion and Howitt's (1992) model of creative destruction (see also Aghion & Howitt, 1997; Howitt & Aghion, 1998). The *second* exception is constituted by the endogenous market structure models by Peretto (1998, 1999a, 1999b), and the *third* is the scientific knowledge creation paper by Sanders (2007). The *fourth* exception is the imitation model developed by Schmitz (1989). Of these four exceptions, the model by Aghion and Howitt has been the most influential, and we will discuss it in some detail.

Aghion and Howitt introduce the notion of Schumpeterian "creative destruction" into a growth model by having firms invest resources in research to achieve a new product that renders the previous product obsolete.[21] Capital is excluded from the basic model while economic growth results from technological progress, being a result of competition among firms that generate innovations. Firms are motivated by the prospect of (temporary) monopoly rents after a successful innovation is patented. Another innovation will again destroy these rents, as the Schumpeterian entrepreneur is making the existing good obsolete. We will discuss a simple version of the basic model as presented by Aghion and Howitt in their Section 2. The non-mathematically oriented reader may want to proceed to the section below Eq. (20.15).

The Aghion and Howitt (1992) Model

Assume that there are four different kinds of units: a final consumption good y, an intermediate good x, unskilled labor used to produce the final good and skilled labor that can be used to produce the intermediate good or that can be used in research.

[20] See also Braunerhjelm (2008), who discusses how knowledge creation and diffusion can be integrated into existing growth models.

[21] It may be argued that Schumpeterian entrepreneurship cannot be modeled using standard assumptions of the neo-classical model such as profit maximization. It is evident that the Aghion and Howitt models fail to do complete justice to Schumpeter's discussions of the motivations that underlie entrepreneurial behavior.

The total amount of unskilled labor is fixed at M. The total amount of skilled labor is fixed at N, and the amount used to do research is denoted by n, leaving N-n units for production of the intermediate good. The final good is assumed to be produced using a Cobb-Douglas type of production function (with input factors of unskilled labor and intermediate goods), and since M is fixed, it can be written as

$$y_t = A_t x_t^{\alpha} \qquad 0 < \alpha < 1 \tag{20.10}$$

where t is the index of the period. The parameter A_t denotes the productivity of the intermediate input in period t. The intermediate good is produced using skilled labor not used for research and linear technology:

$$x_t = N - n_t. \tag{20.11}$$

Innovations arrive in a random sequence, with the Poisson arrival rate for innovations in the economy equal to λn_t (see also Howitt & Aghion, 1998, Eq. (6)). The arrival rate depends only upon the current flow of inputs to the research. Hence, there is no memory in the technology of research. The index t of the period increases by one each time a new innovation arrives; hence, it is not a time index. The length of the time interval from t to $t+1$ is random and has an exponential distribution with parameter λn_t. During this time interval, prices, and quantities are assumed to be constant. Each innovation (the invention of a new intermediate good) makes the previous intermediate good obsolete because it allows the production of the final good y_t to become more efficient. The increase in efficiency is determined by the factor :

$$A_t = A_0 \gamma^t \qquad \gamma > 1. \tag{20.12}$$

The model is a "winner takes it all"-model in the sense that a successful innovator is assumed to receive a patent that is used to monopolize the intermediate sector. The patent lifespan is assumed to be infinite but the monopoly lasts only till the next innovation when the intermediate good is replaced by the next vintage. Each market is assumed to be perfectly competitive with the exception of the monopolized intermediate sector.

The successful innovator has a temporary monopoly and seeks to maximize the profit during this interval. The final good sector will choose the amount of intermediate goods, x_t, so as to maximize $y_t - p_t x_t$ with the price of the final good as the "numéraire" and p_t as the price charged by the monopolist. The first-order condition is

$$p_t = \alpha A_t x_t^{\alpha - 1}. \tag{20.13}$$

The monopolist takes this condition into account and maximizes its profit $\left(\alpha A_t x_t^{\alpha-1} - w_t\right) x_t$ with w_t as the wage level of the skilled laborer. Optimization gives us outcomes for profit, price, and output of the intermediate good:

$$\pi_t = \left(\frac{1-\alpha}{\alpha}\right) w_t x_t, \qquad p_t = w_t/\alpha \quad \text{and} \quad x_t = \left(\frac{w_t}{\alpha^2 A_t}\right)^{1/(\alpha-1)}. \tag{20.14}$$

The above notation gives the key parameters for the stationary equilibrium value for the amount of resources devoted to research (where $n_t = n_{t+1} = \hat{n}$). Aghion and Howitt derive this to be:

$$\hat{n} = \frac{\gamma(1-\alpha)/\alpha}{1+\gamma(1-\alpha)/\alpha} N - \frac{r}{\lambda(1+\gamma(1-\alpha)/\alpha)} \tag{20.15}$$

with r being the constant rate of time preference. Equation (20.15) shows a direct connection between research in stationary equilibrium $\hat{n}$ and the degree of market power. The higher the value of α, the lower the degree of market power. Specifically, $1-\alpha$ is the Lerner index (price minus marginal costs divided by price). Hence, some extent of market power used to achieve rents is needed for Schumpeterian entrepreneurs to engage into research. Aghion and Howitt (1992, 336) derive the average growth rate of real output as $\lambda\hat{n}\ln(\gamma)$. The effect of market power attracting entrepreneurial energy shows the importance of imperfect competition to the growth process.

Competition and growth are inversely related in this Schumpeterian model, something that is usually not supported by empirical evidence (for instance, see Nickell, 1996). Aghion and Howitt (1997), therefore, extend their model to show that a more competitive market structure may contribute to economic growth. In Howitt and Aghion (1998), the authors add capital to their model of creative destruction. They show that capital accumulation and innovation are complementary processes and equal partners in the growth process. Aghion and Howitt have contributed to the endogenous growth literature by connecting purposive, profit-seeking investment in knowledge to the persons performing this task: entrepreneurs.

Other Endogenous Growth Models Including Entrepreneurship

In a series of papers, Peretto introduces a different kind of endogenous growth model in which an endogenous market structure is incorporated. His model includes a key role for the number of firms, again in the intermediate sector, determining the returns to investment and R&D. An important difference between his model and the model by Aghion and Howitt is the assumption that monopolistic firms in the intermediate sector set up in-house R&D facilities to produce a continuous flow of cost-reducing innovations. This sets it apart from the model of independent research firms in Aghion and Howitt (1992). The relation between the number of firms and returns to investment and R&D in the Peretto (1999b) model is determined by a trade-off between external and internal economies of scale. External economies of scale are a result of complementarities across firms because aggregate output is increasing in the number of intermediate goods. Having a large number of firms

in the model therefore leads to high specialization, large investment and R&D programs, and fast growth. On the other hand, the fragmentation of the market due to the large number of firms leads to lesser investment and fewer R&D programs, as well as to slow growth. An increase in the number of firms increases the market size through the specialization effect, whereas each firm's market share is reduced through the fragmentation effect. As a consequence, there is a hump-shaped relation between the number of firms and economic growth.

In Peretto (1998), entrepreneurs play a more visible role. His model seeks to explain a shift in the locus of innovation from R&D undertaken by inventor-entrepreneurs ("competitive capitalism") to R&D undertaken within established firms in close proximity to the production line ("trustified capitalism"). In the model, the economy converges to a stable industrial structure where entrepreneurial R&D and the formation of new firms peter out while corporate R&D undertaken by established oligopolists drives growth.[22] While it is true that from about 1870 to roughly 1970, the corporate laboratories affiliated with large manufacturing firms were increasingly responsible for commercial R&D, the disappearance of entrepreneurial energy as an important determinant of economic growth is an unrealistic feature of the model. In Peretto's setup, entrepreneurs must develop new differentiated products, since entering an existing product line in Bertrand competition with the incumbent is bound to lead to losses because of sunk entry costs. Entrants are net creators of knowledge, as "they create a new product and the knowledge necessary to run manufacturing operations." (p. 58). Although in its more developed stages the economy in Peretto's model experiences a transition from entrepreneurial to corporate R&D, entrepreneurship plays a vital role in economic development: only when a critical number of firms have entered the market do established firms begin investing in R&D. A key result of Peretto's models is that "there is an inverted-U relationship between the number of firms and steady-state growth" (Peretto, 1999a, 1762).

Sanders (2007) extends the normal endogenous growth model by including a separate "basic science" sector dedicated to producing new fundamental knowledge. He argues that scientific knowledge creation follows a reputation-driven, paradigm-shifting dynamic as described by Kuhn. This knowledge creation leads to entrepreneurial opportunities as an unintended side-product. The entrepreneurs then commercialize the opportunities that new knowledge creation presents, enjoying the profits as their reward. These innovative activities drive economic growth. Sanders therefore argues that "a self-governing community of scientists that generates a flow of fundamental knowledge in the pursuit of reputation" (p. 344) is the basis of economic development. Hence, he sees "scientific institutions and entrepreneurial activity as prerequisites for economic growth" (p. 339). This is because innovation opportunities are not exhausted only if scientists increase the

[22] This is an *escalation effect*: the decrease in the number of firms is due to technological opportunities leading firms to invest in R&D, which is characterized by sunk costs that make entry and incumbency more costly and labor more scarce for production.

stock of "potential opportunities" from time to time. The endogenous growth model by Sanders contributes to the literature by modeling where the possibilities for new innovations come from in the first place.

Schmitz (1989) was the first to present an endogenous growth model relating entrepreneurial activity and economic growth. However, his entrepreneurs are more "passive" than in the other models because their role is restricted to that of "imitation." This may have contributed to the Schmitz model's being less influential than the Aghion and Howitt model. His model implies that the equilibrium fraction of entrepreneurs in an economy is lower than the social optimal level, providing a rationale for policies stimulating entrepreneurial activity. We end this section by stressing that one may also set up endogenous growth models in which (a specific notion of) entrepreneurship may not be beneficial to growth. Peng (2000) constructs such a model in which entrepreneurs do not carry out research but, rather, choose between research projects. He finds a negative relationship because of the rent-seeking element in the exercise of entrepreneurship.[23]

Strands of Empirical Evidence

There are various strands in the empirical literature showing the effect of entrepreneurship on economic growth. We concentrate on three strands of empirical research: the regional, industry, and national levels. The *first* strand concentrates on the effect of (changes in) the size distribution in *regions* on subsequent economic growth. If a region has a larger share of new or small firms as compared to another region, this could indicate a higher level of entrepreneurial activity. The empirical "knowledge filter" literature is an important recent development in regional research stressing that new venture creation is an essential mechanism for converting new knowledge into economic knowledge. The *second* strand investigates the effect of the number of market participants in an *industry* on economic growth. An increase in the number of competitors or more turbulence (entry and exit) is usually related to more intensive entrepreneurial activity. The *third* strand of empirical literature concentrates on the effect of the number of self-employed individuals (business owners) or people with entrepreneurial intentions on subsequent growth. In economically developed *nations*, the rate of self-employment will be related to the extent of entrepreneurial activity. New firms usually begin with a phase of solo self-employment, *viz*., with no paid employees. The Global Entrepreneurship Monitor research program is a promising contributor to this strand of the literature. A fourth source of evidence on the relation between self-employment and progress is the economic history of the formerly centralized planned economies. A characteristic of these economies was the almost complete absence of small firms (and private

[23]The idea that entrepreneurial energy as such may not suffice for economic progress is also expressed by Baumol (1990), who stresses the importance of entrepreneurship being led into productive channels.

ownership of the means of production), and this extreme monopolization constituted one of the major factors leading to the collapse of state socialism (Acs, 1996). The development of small enterprises is considered a vital part of the current transition process in Eastern Europe. This last source of evidence is not discussed in the present chapter.[24]

Regional Evidence

We now proceed to concentrate upon empirical contributions that detail the impact of entrepreneurship on subsequent economic performance at the regional level. The unit of observation for these studies is spatial: either a city, a region or a state. The most common measure of performance is economic growth, typically measured in terms of employment growth. These studies try to link various measures of entrepreneurial activity, most typically startup rates, to subsequent performance.

Reynolds (1999) finds some evidence that turbulence is related to economic growth using American Labor Market Area data for 1980–1992. Labor Market Areas generally include a metropolitan area and the surrounding rural area from which it draws both employees and consumers. Acs and Armington (2004) link a measure of entrepreneurship to growth at the Labor Market Area level. Their measure of entrepreneurial activity is the new-firm birth rate in each of these local economies. They test the hypothesis that increased entrepreneurial activity leads to higher growth rates for local economies. They find that higher levels of entrepreneurial activity are strongly positively associated with higher growth rates, even after controlling for establishment size, and agglomeration effects.

Audretsch and Fritsch (1996) analyze a database identifying new business startups and exits based on the social insurance statistics in Germany to examine whether a greater degree of turbulence leads to greater economic growth. Each record in the database identifies the establishment at which an individual is employed. The startup of a new firm is recorded when a new establishment's identification appears in the database, which generally indicates the birth of a new enterprise. While there is some evidence that in the United States, a greater degree of turbulence at the regional level is linked to higher rates of growth for regions (Reynolds, 1999), Audretsch and Fritsch (1996) find that the opposite was true for West Germany during the 1980s. In both the manufacturing and the service sector, a high rate of turbulence in a region tended to lead to a lower and not a higher rate of growth. They attribute this negative relationship to the fact that the underlying components – the startup and death rates – are both negatively related to subsequent

[24] Other examples of the role of entrepreneurship in economic history are given in Wennekers et al. (2002, 2010).

economic growth. Similar evidence for West Germany is found by Fritsch (1997).

Divergent findings from the 1980s about the relationship between the degree of entrepreneurial activity and economic growth in the United States and West Germany posed something of a puzzle. On the one hand, these diverging results suggest that the relationship between entrepreneurship and growth lacks a general pattern across developed countries. On the other hand, the results also provide evidence for the existence of distinct and different national systems capable of supporting economic growth. However, in a more recent study, Audretsch and Fritsch (2002) find different results for the 1990s. Those regions with a higher startup rate are found to exhibit higher growth rates in this more recent time period. This would suggest that, in fact, Germany is changing over time, as its engine of growth is shifting to rely on entrepreneurship. Based on the empirical evidence that the source of growth in Germany shifted away from the established incumbent firms during the 1980s to entrepreneurial firms in the 1990s, it would appear that, despite persisting institutional differences, the relationship between entrepreneurship and growth in the two countries tends to converge.

The positive relationship between entrepreneurship and growth at the regional level is not limited to Germany in the 1990s. For example, Foelster (2000) examines not just the employment impact within new and small firms but also the overall link between increases in self-employment and total employment in Sweden between 1976 and 1995. He provides a link between micro behavior and macroeconomic performance, showing that increases in self-employment rates have a positive impact on regional employment rates in Sweden. Hart and Hanvey (1995) link measures of new and small firms to employment generation in the late 1980s for three regions in the United Kingdom. While they find that employment creation came largely from SMEs, they also identify that most job losses also came from SMEs. Robbins et al. (2000) perform an analysis for 48 US states for 1986 through 1995 and find that states with a higher proportion of (very) small business employment experience higher levels of productivity growth and Gross State Product growth. Callejon and Segarra (1999) use a dataset of Spanish manufacturing industries between 1980 and 1992 to link new-firm birth rates and death rates (which, taken together, constitute a measure of turbulence) to total factor productivity growth in industries and regions. They adopt a model based on a vintage capital framework in which new entrants embody the available edge technologies and exiting businesses represent marginal obsolete plants. Using a Hall type of production function, which controls for imperfect competition and the extent of scale economies, they find that both new-firm startup rates and exit rates contribute positively to the growth of total factor productivity in regions as well as industries. Berkowitz and DeJong (2005) find for post-Soviet Russian regions that regional entrepreneurial activity, in terms of number of enterprises per population, has led to subsequent growth. The data are for 70 regions over the period 1993–2000. The private enterprises in the regions can be seen as having consisted of either small-scale startups or private spin-offs from previously state-run enterprises.

Recent literature emphasizes the role of entrepreneurship in translating knowledge investments into economic progress (see Audretsch et al., 2006). This literature argues that new knowledge does not automatically generate anticipated levels of economic growth. Audretsch (2007) and Audretsch and Keilbach (2008) use the term "European Paradox": a combination of high investments in knowledge and low growth performance. The "knowledge spillover" theory argues that this is caused by a lack of entrepreneurial initiatives able to penetrate the so-called knowledge filter. Acs and Plummer (2005) use Colorado data to provide empirical evidence that new venture creation is a better mechanism than the absorptive capacity of incumbent firms for converting new knowledge into economic knowledge. Audretsch and Keilbach (2008) and Mueller (2006), both using German data, find that entrepreneurship and R&D intensity promote regional economic growth.[25] Mueller, in addition, claims that university–industry relations also contribute to regional economic performance. In a related paper, Mueller (2007) stresses the importance of startup activity in technology- and knowledge-intensive industries rather than just that of increases in general entrepreneurship. The obvious policy implication derived is the facilitation of the spillover and commercialization of knowledge through the encouragement of entrepreneurship.

Industry Evidence

Nickell (1996), Nickell et al. (1997) and Lever and Nieuwenhuijsen (1999) present evidence that competition, as measured by the increased number of competitors within an industry, has a positive effect on the rate of total factor productivity growth. This positive effect is consistent with Geroski's (1989) findings regarding the increase in overall productivity growth in 79 UK manufacturing industries along with a lagged rate of gross entry of new firms. One reason for these findings is that an increased number of market participants and increased entrepreneurial activity often go hand in hand. There have been some studies on the impact of the number of market participants on regional industrial growth as well. Glaeser et al. (1992) examine three determinants of regional sectoral growth: specialization, diversity, and competition. They find that local competition, measured as the relative number of businesses per worker, encourages employment growth in industries. Caves (1998, 1973) concludes that in the short run, turnover from entry and exit appears to make only a very small contribution to an industry's productivity growth. However, he adds that in the long run, entry–exit turnover makes a more important contribution.

[25] Jaffe et al. (2007), in an editorial to a special issue of *Journal of Economic Behavior and Organization* on academic entrepreneurship, conclude that the "dual engines of growth" being the process of scientific discovery and industrial innovation, appear to reinforce each other in the contribution of research to the process of economic growth.

The empirical evidence of the effect of (changes in) the size distribution of firms on subsequent growth performance appears clear-cut, at least for data from the late 1980s and early 1990s. Carree and Thurik (1998, 1999a) show that the share of small firms in manufacturing industries in European countries in 1990 has had a positive effect on industry output growth in the subsequent 4 years. Audretsch et al. (2002) find evidence for 17 European countries that the consequences for economic growth of not shifting the industry structure away from large businesses and toward small businesses have been rather large. Likewise, Carree (2002) shows evidence for the five largest economies (France, Germany, Japan, the UK, and the United States) that manufacturing industries that underwent little downsizing in the 1977–1990 period also experienced less subsequent growth than was typical internationally.[26]

Country Evidence

A third strand of literature focuses on the effect of self-employment and entrepreneurship on growth at the country level. Using a panel of OECD countries, Blanchflower (2000, 497) finds no evidence that increases in the self-employment rate result in increasing economic growth. However, he uses uncorrected OECD Labor Force Statistics data, which suffers from a lack in comparability across countries and, in some cases, lacks comparability over time due to changes in counting procedures. Carree et al. (2002, 2007) investigate whether countries that deviate from an "equilibrium" business ownership rate for comparable levels of economic development suffer in terms of economic growth. In their view, discrepancies between the actual and the "equilibrium" rate of business ownership will diminish the growth potential of an economy in the medium term. A shortage of business owners will likely diminish competition, with detrimental effects for the static efficiency and competitiveness of the national economy. It will also diminish variety, learning, and selection and thereby harm dynamic efficiency (innovation). On the other hand, a glut of self-employment causes the average scale of operations to remain below optimum level. It will result in large numbers of marginal businesses, absorbing capital and human energy that could have been allocated more productively elsewhere. Carree, van Stel, Thurik, and Wennekers develop an error–correction model to determine the "equilibrium" rate of business ownership as a function of GDP per capita.[27] Their estimated "equilibrium" relationship, using corrected OECD Labor Force Statistics data, is presented in Fig. 20.1 together with the actual (corrected) data of the G7 countries. Their estimation results show that a

[26]Engelbrecht (1997) also shows that inefficient corporate bureaucracies have had a negative impact on US export competitiveness. Denis and Shome (2005), among others, show that downsizing has had a positive effect on firm financial performance.

[27]Carree et al. (2002, 2007) hypothesize a "U-shaped" equilibrium relationship between the rate of business ownership and per capita income but, in fact, find it to be impossible to statistically discriminate between U-shaped "equilibrium" functions and L-shaped functions.

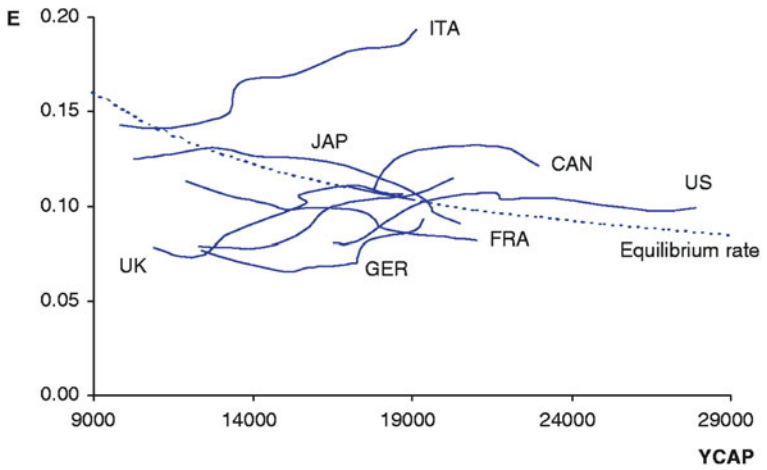

Fig. 20.1 The actual and equilibrium rate of business ownership for G7 countries, 1972–2004 Note: E stands for the ratio of self-employed over labor force. YCAP stands for GDP per capita in US dollars (of 1990)
Source: Carree et al. (2007).

deviation of the actual number of business owners from the "equilibrium" rate has a significantly negative impact on economic growth.

Figure 20.1 shows that several European countries had too few self-employed individuals relative to the equilibrium value. An obvious exception is Italy. Data indicate that the high level of self-employment in Italy is not efficient and it has a relatively large negative impact on economic growth.[28] Countries with low business ownership rates compared to the equilibrium include the Scandinavian countries. Each of these economies is characterized by a large public sector, relatively low entry and exit rates and high taxes. Eliasson (1995) and Braunerhjelm and Carlsson (1999) blame part of Sweden's relatively bad economic performance in the 1980s on limited private initiative and a lack of structural adjustment. Another country with a relatively low level of business ownership rate is Germany. Figure 20.1 also shows that, at least until recently, Germany has failed to restructure where, for example, the United Kingdom has. Klodt (1990) blames (West) German industrial policy for repressing structural change in supporting large-scale industries with subsidies. An important reason for the lack of a vibrant sector of new firms and industries in Germany until the mid-1990s were the high barriers to innovative activity (Audretsch, 2000). Thurik (1996) reports, related to this, that the excess growth

[28] In Italy, research and development expenditures are by far the lowest among the largest OECD countries as a percentage of gross national product. This is in line with the idea that when there are too many business owners, the scale advantages in research and development are not utilized. See Cohen and Klepper (1996).

of small firms[29] had a positive influence on percentage change in gross national product for a sample of 16 European countries in the period 1988 through 1993.

It should be stressed that the number of self-employed individuals is a possible yardstick for entrepreneurship, as statistical information is often available along the ownership dimension. However, this yardstick can be misleading. For instance, it is unknown whether the relatively high number of self-employed in Italy as compared to Germany indicates a high level of Schumpeterian entrepreneurship or merely a time lag in economic development, influencing the number of marginal establishments or merely differences in sectoral composition. Other approximations are brought to the fore in other empirical studies. Audretsch (1995) uses the employment share of surviving young firms as a proxy for entrepreneurial activity in manufacturing industries. This variable may well express the comparative entrepreneurial positions of these industries. Outside the manufacturing sector, this variable may be biased due to the occurrence of franchising firms and marginal or part-time startups. Moreover, the rate of intrapreneurship in both new and incumbent firms is missing.

The Global Entrepreneurship Monitor (GEM) research program (Reynolds et al., 2005) is yet another approach. It seeks to assess the level of national entrepreneurial activity and to relate this to the rate of economic growth. Entrepreneurial activity is measured through questionnaires in 43 countries (2008). It started with 10 countries in the first year of assessment, 1999; it included 21 countries in 2000; and 29 countries in 2001. The research program shows some preliminary evidence that the level of entrepreneurial activity is related to economic growth. Van Stel et al. (2005) argue that this effect is dependent upon the level of economic development. Increased entrepreneurial activity is especially beneficial to well-developed economies. Less well-developed economies appeared to benefit less from additional new entries of entrepreneurial initiatives that are often very small. An important reason is the abundance of necessity entrepreneurship in these countries. Acs (2006) shows that the opportunity–necessity entrepreneurship ratio is low for countries like Brazil and Uganda. It is likely that entrepreneurial activity that grows out of opportunity will, on average, lead to more subsequent economic growth than necessity entrepreneurship.

A final example of the influence of entrepreneurship on growth at the country level is in Erken et al. (2009), where total factor productivity (TFP) is used as an indicator. A panel of averaged annual data is used from 20 OECD countries spanning 1971–2002. TFP is computed as the ratio between the real gross domestic product and a weighted sum of hours of labor and capital of firms. Entrepreneurship is computed as the ratio between the actual business ownership rate (number of business owners per workforce) and the "equilibrium" business ownership rate. This ratio corrects for the influence of per capita income as found in Carree et al. (2002, 2007).

[29] The excess growth of small firms in that study is defined as the percentage change in the value-of-shipments accounted for by small firms minus that accounted for by large firms.

The outcomes of five different literatures explaining TFP are reproduced where variables such as private and public R&D capital, foreign R&D capital, human capital, catching up with the technological leader, labor participation, and hours worked play important roles. Finally, entrepreneurship is taken into account and the results show it to be a driver of productivity. It has a small but stable and significant impact on the development of productivity levels.

The Time Lag Structure

There may be important lags between changes in the composition of the (small) business sector and changes in economic performance because of the time-consuming nature of the processes of selection and learning about what consumers prefer, what is technologically viable and how to obtain the necessary resources. Fritsch and Mueller (2004) made an important contribution, showing that there may be both positive and negative effects of new firm formation on regional employment change that occurs with different time lags. Fritsch and Mueller propose a lag structure with three stages. These are shown in Fig.20.2.

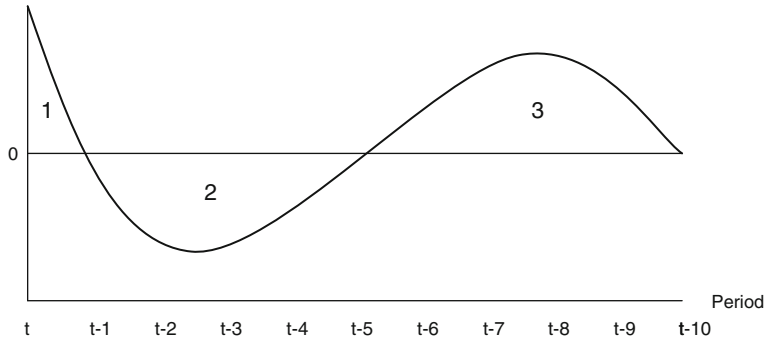

Fig. 20.2 Lag structure of the impact of new business formation on employment change

The first stage is one of the easily identifiable direct positive employment effects of new capacities. The impact occurs when startups in the current year create additional jobs at the time of inception. The second stage is one of exiting capacities based on the infant mortality of startups and the crowding-out of incumbents. The displacement of inefficient incumbents may lead to a negative impact on employment growth. The last stage is the stage in which the startups again contribute to employment via direct or indirect supply-side effects. In the longer term, the successful new firms promote increased efficiency due to intensified competition and process innovation and enhance market demand due to product innovation, leading to a greater variety of products and hence to a better correspondence to the diversity of consumer preferences. After the third period, the new firms can be considered to have become incumbents themselves, and the effects phase out.

Fritsch and Mueller find that the peak of the negative impact and that of the positive impact occur at about 3–4 years and 6–7 years after startup, respectively. However, Fritsch (2008), in the introduction to a special issue of *Small Business Economics*, argues that the timing of peaks may be region- and sector-dependent. Fritsch and Mueller (2008) find that regions with less labor productivity benefit less from new firms. Mueller et al. (2008) find that regions that are less entrepreneurial also tend to be characterized by a "wrong type" of entrepreneurship when new firms enter. As Fritsch and Mueller (2004) claim, the effect of new entrants is threefold: the first effect is to increase employment, the second is to lower employment, and the third is to again increase employment. The total effect upon employment can therefore be either positive or negative depending upon the magnitude of the three elements. Carree and Thurik (2008) examine the lag structure of the impact of changes in the number of business owners on three measures of economic performance: employment growth, GDP growth, and labor productivity growth. Their results confirm earlier evidence of three stages in the impact of entry on economic performance using country-level data: the initial direct positive effect, followed by a negative effect due to exiting capacities and, finally, a stage of positive supply-side effects. The net effect is found to be positive for employment and GDP growth. Changes in the number of business owners have no effect on labor productivity. Thurik et al. (2008) show that the lags between growth in business ownership rates at the country level and subsequent decrease in unemployment rates can take up to 8 years.

Conclusion

We expect a framework relating entrepreneurial activity to economic growth to hinge on at least four elements. *First*, it should identify the micro-economic foundations of growth, emphasizing the role of knowledge externalities in the growth process (Romer, 1986, 1994). The model by Sanders (2007) is an example. *Second*, it should identify intermediate linkages from entrepreneurial activity to economic progress. The "knowledge spillover theory" literature appears to contribute substantially to that. *Third*, it should deal with dual causality in the relation between entrepreneurial activity and growth. A contribution in this regard is Thurik et al. (2008). And *finally*, it should take into account the multidisciplinary character while linking together different levels of analysis.[30] Before discussing some policy issues, we will first present such a framework derived from Wennekers and Thurik (1999).

[30] See Audretsch et al. (2002) for such a framework concerning the determinants of entrepreneurship. See also Wennekers et al. (2002) for more detailed frameworks.

A Framework for Future Analysis

Figure 20.3 presents a framework inspired by the insights reaped from the various strands of the literature. Three levels of analysis can be distinguished, since linking entrepreneurship to economic growth also means linking the individual level to the firm and the macro levels.

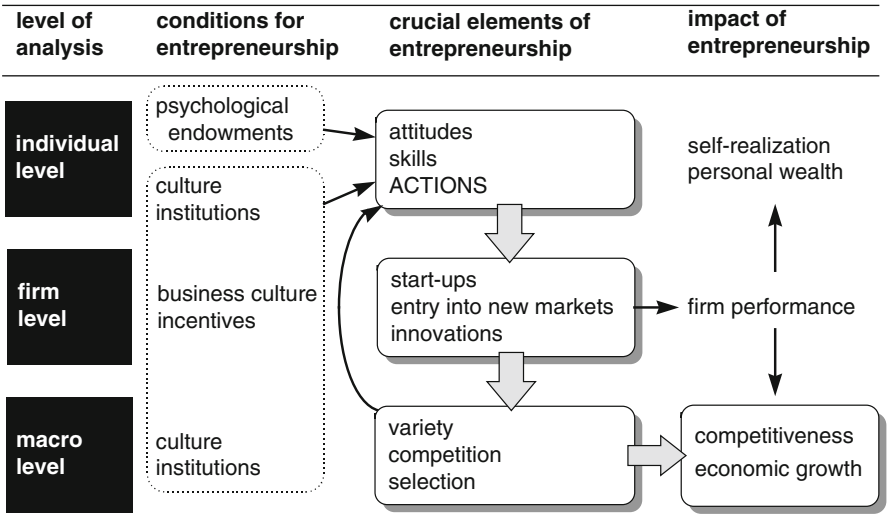

Fig. 20.3 Framework for linking entrepreneurship to economic growth
Source: Wennekers and Thurik (1999).

Entrepreneurial action happens at the firm level. Entrepreneurs need a vehicle for transforming their personal qualities and ambitions into actions. Small firms where the entrepreneur has a controlling stake provide such a vehicle. Larger firms often mimic smallness (using organizational forms like business units, subsidiaries, and joint ventures) to introduce corporate entrepreneurship or intrapreneurship. The outcomes of these entrepreneurial manifestations at the firm level generally have to do with "newness." This can be newness through product, process, and organizational innovation, through entry into new markets, or through innovative business startups. Incumbents can sometimes successfully invest in and harvest innovations from entrepreneurial ventures (Dushnitsky & Lenox, 2005).

At the aggregate level of industries, regions, and national economies, the many individual entrepreneurial actions compose a mosaic of new experiments. In evolutionary terms this can be considered variety. A process of competition between these various new ideas and initiatives takes place, continuously leading to the selection of the most viable firms and industries. Variety, competition, selection, and imitation expand and transform the productive potential of a regional or national economy via

the replacement or displacement of obsolete firms, via higher productivity and via the expansion of new niches and industries.

Schumpeterian entrepreneurs, intrapreneurs, and managerial business owners all play their part in this process (see Table 20.1). Next to the linkages from the individual level to the aggregate level, there are also important feedback mechanisms. Competition and selection amidst variety undoubtedly enable individuals (and firms) to learn from both their own and others' successes and failures. These learning processes enable individuals to increase their skills and adapt their attitudes. The outcome of these so-called spillovers will be new entrepreneurial actions, creating a recurrent chain of linkages.

Clearly, the outcome of these dynamic processes depends on a set of conditions like the ones referred to in Fig. 20.3. *First*, these conditions refer to the national (or regional) cultural environment, and to the internal culture of corporations. The linkages between culture and entrepreneurship are neither simple nor straightforward, and much is still unknown about these processes. The history of the rise and fall of nations has shown that cultural vitality, thriving sciences and a high tide of entrepreneurship often coincide (Wennekers & Thurik, 1999). *Second*, the institutional framework, both on the national level and within firms, defines the incentives for individuals to turn their ambitions into actions and determines to what extent unnecessary barriers hamper them. The importance of institutions to the development of entrepreneurship is paramount and deserves further study.

Some Policy Issues

One of the central goals of public policy that is common among all modern economies is the generation of growth and the creation of employment opportunities. Much of the policy debate on generating growth and jobs has relied on a macro-economic framework and focused on traditional macro-economic policy instruments. The survey of the present chapter suggests that a different, less traditional instrument for generating growth and employment plays an important role —policies that generate and promote entrepreneurship (OECD, 1998).[31] Starting in the mid-1990s, a broad spectrum of enabling policy initiatives that fall outside of the jurisdiction of the traditional regulatory agencies emerged. [32] Empirical evidence surveyed in this chapter suggests that those countries that experienced an increase in entrepreneurial activity also enjoyed higher rates of growth. However, the actual mechanisms, i.e., the intermediate linkages, of how entrepreneurship

[31] Sternberg (1996) documents how the success of a number of different high-technology clusters spanning a number of developed countries is the direct result of enabling policies, such as the provision of venture capital or research support.

[32] An example is the French government's "auto-entrepreneur" stimulus plan that started in January 2009 and has led to tens of thousands of new business startups. See also Audretsch et al. (2007) and European Commission (2000).

generates growth are less obvious. The present chapter relies on a rich body of literature, both theoretical and empirical, taking into account some micro foundations of entrepreneurship. Entrepreneurship generates growth because it serves as a vehicle for innovation and change, and therefore as a conduit for knowledge spillovers. This is the case in particular in a regime of increased globalization, where the comparative advantage of modern economies is shifting toward knowledge-based economic activity. This led Yu to argue that "any policy recommendation on economic development should be based on an analysis that incorporates entrepreneurship, the engine of economic growth" (Yu, 1998, 906). Similarly, Holcombe claims that "the incorporation of entrepreneurship into the framework of economic growth not only fills in the institutional details to help make the growth process more understandable, but also points toward more promising economic policy recommendations for fostering economic growth" (Holcombe, 1998, 60).

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