# Exploiting Entrepreneurial Opportunities: The Impact of Entrepreneurship on Growth

***Abstract:***

Knowledge is recognized as an important ingredient for economic growth in addition to physical capital and labor. While transforming knowledge into products and processes it is exploited commercially. Nevertheless, the existing knowledge stock and the absorptive capacity of actors like employees at firms and researchers at universities and research institutions are conditional for the ability to produce, identify, and exploit knowledge. Since incumbent firms do not exploit new knowledge to the full extent, realized entrepreneurial opportunities may arise. This paper tests the hypothesis whether or not entrepreneurship is an important vehicle for knowledge flows and economic growth. The empirical results indicate that an increase in innovative start-up activity is more effective than an increase in general entrepreneurship for economic growth.

JEL Classification: M13, O18, O31

Keywords: Regional growth, knowledge, entrepreneurship

## 1 Introduction

Entrepreneurial opportunities exist and individuals just need to recognize them. If they have the willpower and decide to exploit an existing opportunity, this will lead to economic growth. Stop – is it really that easy? There are at least two arguments which indicate that the relationship between opportunities, entrepreneurship, and economic growth is more complicated. Firstly, opportunities do not fall from heaven like manna – they need to be created. Secondly, an individual needs to make the decision about whether or not to exploit the opportunity. Demographic and psychological characteristics are a powerful influence on the individual's decision (see Mueller 2006a for an overview of the literature). The process of generating opportunities involves individuals, firms, universities, and research institutions. Their research and development activities not only create new knowledge, they are also the precondition for the ability to identify, absorb, and exploit knowledge. This knowledge may have also been generated by other actors in the same or different industry (Cohen and Levinthal, 1989). Entrepreneurial opportunities particularly arise if existing organizations do not capitalize knowledge to the full extent. Firms with abundant underexploited knowledge are a breeding ground for entrepreneurial opportunities, which may cause spin-offs (Agarwal et al., 2004; Franco and Filson, 2000).

This paper analyzes the relationship between the exploitation of entrepreneurial opportunities and regional economic growth. In particular, this paper explores if those regions that increased their new firm formation activity also experienced higher economic growth rates. The results of Mueller (2006b) indicate that regions with a higher start-up rate also have higher economic performance measured as labor productivity. Assuming that entrepreneurship challenges and displaces less innovative incumbents, entrepreneurship leads to a higher degree of economic

growth (see Schumpeter, 1911; Baumol et al. 1988; Fritsch and Mueller, 2004; Audretsch et al., 2006).

New ventures are suggested to be a mechanism for knowledge diffusion and knowledge exploitation (see also Acs et al., 2005). New firms, founded to capitalize abundant underexploited knowledge, may also amplify innovation by introducing new products and processes to the market (Audretsch, 1995). However, the origin of opportunities is also driven by the presence of R&D intensive incumbent firms. The greater the presence of knowledge- and technology-intensive incumbent firms the more entrepreneurial opportunities may arise and exploited. Certainly, regional economic growth is only partly stimulated by entrepreneurship but mainly determined by research and development activities in existing firms, investments in physical capital stocks, and human capital. Knowledge generated through R&D activities of existing firms represents the knowledge stock for this particular region. Consequently, regions with less research and development activities are characterized by a lower level of absorptive capacity and are expected to experience lower growth rates.

This paper is organized as follows. Section 2 presents the theoretical framework and links the exploitation of entrepreneurial opportunities to economic growth. The methodology and database is described in section 3. It is empirically tested if the development of start-ups is a mechanism to facilitate knowledge spillover and thus stimulate growth in economic output (section 4). Section 5 provides a summary and a conclusion.

## 2 Knowledge, Entrepreneurial Opportunities and Their Impact on Economic Growth

With the new growth theory, knowledge is recognized as an essential driver of economic growth. However, it is rarely linked to economic growth in empirical analyses. Knowledge may increase productivity by stimulating technological progress. Romer (1986, 1990) and Lucas (1988) explained economic growth through the accumulation and spillover of technological knowledge. New knowledge may lead to innovations and is capitalized by transforming it into new products, processes, and organizations. Private businesses, universities, and other research institutions generate new knowledge through research and development. The created knowledge may be exploited by the knowledge-producer or by other organizations; therefore, knowledge flows are crucial. These other organizations may be other existing firms in the same industry, related or different industries or disciplines, or individuals who decide to leave their current employer to start their own venture.

Cohen and Levinthal (1989) argue that research and development activities not only generate innovations but also increase the firm's ability to identify, assimilate, and exploit externally created knowledge (see also Cohen and Levinthal, 1990; Zucker et al., 1998) for more details on absorptive capacity). Applied on the regional level, this would indicate that the higher the level of research and development activities in a region is, the more the region's absorptive capacity will be developed. Various empirical analyses have shown that knowledge spillovers are spatially bounded (Jaffe et al., 1993; Anselin et al., 1997, 2000; Audretsch and Feldman, 1996; Audretsch and Lehmann, 2005; Audretsch et al., 2004). Knowledge depends on a strong regional component, taking advantage of spatial proximity to research facilities, universities, and industry specific agglomerations. Analyzing patent citations, Jaffe et al. (1993) found that knowledge spillovers from academic research

to private industries have a strong regional component (see also Arundel and Geuna, 2004, for the importance of proximity for the use of public science). The argued explanation for the regional localization of knowledge is usually the tacit nature of knowledge which requires direct, inter-personal contacts to be obtained (Anselin et al., 1997, 2000; Maskell and Malmberg, 1999; Hippel, 1987; Senker, 1995). Arundel and Geuna (2004) propose that as long as there is a delay between the discovery of knowledge and its codification, inter-personal interactions are premier mechanisms for knowledge flows. Hence, proximity may be relevant because local, direct, and inter-personal contacts enable businesses to access knowledge faster and more successfully and firms are more likely to know the source of new knowledge where they can draw from (see Gorman, 2002 for an overview of the different types of knowledge).

Knowledge may be underexploited to a large extent. First, incumbent firms do not want to take the risk combined with new products or processes. Secondly, they do not value the emerged new opportunities to be profitable. Incumbents could be more interested in exploiting the profit possibilities of their given product program than realizing new opportunities (Audretsch, 1995; Geroski, 1995). Internal constraints (e.g., financial resources) might also hinder the commercialization of knowledge in these firms. Another reason might be that the research at universities and research institutions, in particular, is hardly translated into new products or services (Pavitt, 2001). Consequently, abundant knowledge exists, which may spur economic growth if it is also commercialized. In order to exploit it, firms or individuals must be able to recognize the underexploited knowledge, which requires absorptive capacity. Moreover, channels for knowledge spillovers need to exist, and the creation of new firms could be such a channel.

Starting a firm in order to realize an entrepreneurial opportunity is assumed as a mechanism for knowledge diffusion and for the exploitation of knowledge. If the founders of new ventures worked for incumbent firms or universities before commercializing their new knowledge, they inherit knowledge from their former employer. Studies on spin-offs have found that the reasons that cause individuals to leave their employer and to create their own firm are mainly frustration with their current employer and the expectation of greater financial rewards (see Garvin, 1983; Klepper, 2001; Klepper and Sleeper, 2005; Agarwal et al., 2004 for an overview). Particularly, frustration may arise among the scientists and engineers if their ideas about a new product or process are rejected by their supervisors or top management (see Garvin, 1983 for examples). Agarwal et al. (2004) found that, in particular, incumbent firms with abundant underexploited knowledge represent seed beds for spin-offs. According to Audretsch (1995), many radical innovations have been introduced by new firms rather than by incumbents. Especially in high-tech industries, employee mobility and spin-offs are an important mechanism for knowledge diffusion. In these industries, a high share of the new ventures is started by employees from incumbent firms by using some of the technological know-how of their former employer (Klepper, 2001). Franco and Filson (2000) propose that existing firms characterized by technological know-how and continuous innovation provide a training ground for future entrepreneurs.

Regarding the relationship between entrepreneurship and economic growth, it can be expected that new firms in knowledge or technology-intensive industries are more relevant for economic growth. These firms tend to be more innovative and to be of higher quality than other entrants, and these characteristics may, in particular, facilitate growth. Innovative start-ups may greatly challenge incumbent firms,

thereby, securing their efficiency and enhancing structural change. Due to their innovativeness, these start-ups are most likely to amplify innovation and increase product variety. Christensen (1993) analyzed entry in the U.S. disk drive industry between 1976 and 1989; he found that spin-offs were more successful in surviving and that they generated more revenues than the non-spin-off entrants. A recent analysis of the disk drive industry supports the findings of Christensen; Agarwal et al. (2004) use data from the disk drive industry between 1977 and 1997 and can show that the probability of survival is higher for spin-offs than other entrants and that higher technological know-how also positively affects the survival chance.

## 3 Data and Methodology

The purpose of the paper is to develop a regional model of economic growth for the West German regions between 1990 and 2002 and empirically test the hypothesis if an increase in entrepreneurship fosters economic growth. The analysis is restricted to West Germany because East Germany can be regarded as a special case with very specific conditions not comparable to the West in the 1990s (Fritsch, 2004; Kronthaler, 2005). The analysis focuses on the 1990s because data on innovative start-ups were not available for the 1980s. Since this analysis focuses on the increase of the output and input variables compared to the initial condition in 1990, the estimations account for a change between $t$ and 1990. The spatial framework is on the level of planning regions. The advantage of planning regions is that these regions are functional units that consist of at least one core city and the surrounding area. Furthermore, planning regions account for economic interaction and the fact that core cities are usually strongly interwoven with their surrounding area. Therefore, the degree of spatial autocorrelation can be assumed to be rather low; lower than between districts.

The following model is employed to analyze the impact of changes in capital, labor, R&D activities, and entrepreneurship on economic growth:

$$\begin{aligned}\ln Y_{it} - \ln Y_{i1990} = \quad & \alpha_1(\ln K_{it} - \ln K_{i1990}) + \alpha_2(\ln L_{it} - \ln L_{i1990}) \\ & + \alpha_3(\ln KNOWI_{it} - \ln KONWI_{i1990}) \\ & + \alpha_4(\ln KNOWP_{it} - \ln KNOWP_{i1990}) \\ & + \alpha_5(\ln E_{it} - \ln E_{i1990}) + \varphi_{it} + \nu_{i,t}\end{aligned}$$

The parameter $\alpha_1$ and $\alpha_2$ measure the impact of a change in physical capital (*K*) and labor (*L*). The effect of an increase in R&D activities in private (*KNOWI*) and public (*KNOWP*) organizations is measured by the parameters $\alpha_3$ and $\alpha_4$. R&D activities in the private and public sector are meant to characterize the regional knowledge stock and, therefore, the absorptive capacity of a region. Regions that increased their knowledge stock are expected to experience stronger economic growth. The parameter $\alpha_5$ measures the impact of an increase in entrepreneurial activity (*E*) on economic growth. It is assumed that the knowledge stock of adjacent regions also affects the regions economic performance. Therefore, a change in number of R&D employees in adjacent regions is included in order to control for regional spillovers ($\varphi_{it}$). The subscript *i* denotes the region and *t* the time period from 1990 until 2002.

Regional gross value added of all industries measures the regional aggregate output *Y* (at constant 1995 prices). The physical capital stock *K* is calculated from gross fixed capital formation (investments, at constant 1995 prices) following the perpetual inventory method (see also Audretsch and Keilbach, 2004a, b). All data on regional gross value added and gross fixed capital formation (investments) are from various publications of the Federal Statistical Office and statistical offices of each state (*Bundeslaender*).[1] Two planning regions had to be excluded from the data set because gross fixed capital formation was not reported due to confidentiality.

The number of employees in private and public organizations measures labor *L*, however, R&D employees are not included since they are measured with *KNOWI* and *KNOWP*. The number of employees in each region is from the establishment file of the German Social Insurance Statistics. In Germany all public and private employees must be reported to the Federal Employment Office for enrollment in the social insurance system. However, civil servants, army personnel, and self-employed are not obliged to contribute to the social insurance system and are, therefore, not included (for details see Fritsch and Brixy, 2004).

The regional knowledge stock, hence the region's absorptive capacity, is measured by R&D activities in private businesses (*KNOWI*) and organizations of the public sector (*KNOWP*) (e.g., research institutions, universities, and other public organizations). Since research and development is carried out by individuals and has a strong tacit dimension, the number of employees devoted to research and development is used as an approximation. The German Social Insurance Statistics provided the data, which were obtained from the employment statistics and are comprised of information on education and occupation of the listed employees. Employees are counted as R&D employees if they have at a university degree in natural science or engineering.

Regional entrepreneurship activity is measured by new firm creation in each region. The number of new firms was provided by the Centre for European Economic Research (ZEW) and was taken from their ZEW Firm Foundation Panel. The foundation panel is based on data provided biannually by Creditreform, the largest German credit-rating agency (for more details, see Almus et al., 2002). The data contain virtually all entries in the German Trade Register. Especially firms with large credit requirements such as high-technology firms are completely recorded. In 2002

about 180,000 entries were listed in Creditreform's database for West Germany. The information is available on the regional level and for a relatively long time period, between 1990 and 2003. The ZEW also provided the aggregated number of innovative start-ups for each region, which includes start-ups in knowledge- and technology-intensive industries. Therefore, the empirical analysis specifically differentiates between the impact of start-ups in innovative and the remaining industries. It is assumed that entrepreneurship in knowledge or technology-intensive industries has a stronger impact on economic growth because these start-ups are expected to be of higher quality and higher survival chances. Thus, they greatly challenge incumbent firms.

## 4 Entrepreneurial Opportunities and Economic Growth

The region's knowledge stock and entrepreneurial activity are expected to have a strong impact on regional economic growth: regions benefit from research and development activities and from individuals who exploit new knowledge by realizing entrepreneurial opportunities. The results indicate that regions which increased their knowledge stock through R&D activities in private and public industries compared to their initial conditions in 1990 and which increased their new firm formation activity compared to 1990 also realize stronger economic growth (table 1).

*-- Table 1 about here --*

It is very apparent that knowledge generated by private businesses has a much higher impact than knowledge from public organizations. The coefficient for the development of public R&D is lower and less significant. Reasons for the lower effect of knowledge created in public organizations could be that this knowledge, especially if it is created in universities or research institutions, hardly results in ready-to-

produce innovations and is rarely translated into new products or services in the short run (Pavitt, 2001). A capitalization of the public knowledge stock is facilitated by different mechanisms such as private firms hiring researchers or graduates, research partnerships with private firms, or spin-offs from universities. The results indicate that an increase in the region's knowledge stock generated by R&D carried out in private businesses is the fundamental determinant of economic growth. Therefore, regions were able to perpetuate and increase economic growth if they developed a strong regional knowledge stock.

Entrepreneurship proves to be an important vehicle for exploiting opportunities and stimulating growth: an increase in new firm formation activity stimulates economic growth. The results support Audretsch and Keilbach (2004a, b) and Acs et al. (2005) who also found a positive relationship between entrepreneurship and economic growth (see also Mueller, 2006b). Nevertheless, it is crucial to raise innovative start-up activity, which is more important than an increase in general start-up activity. A distinction between technology- and knowledge-intensive industries and the remaining industries demonstrates that the positive impact is based upon an enhancement of new innovative ventures. Innovative start-ups represent a greater challenge for incumbent firms and enhance the efficiency of incumbents which may lead to greater economic growth. While Mueller (2006b) showed that innovative new firms are a premium on top of general entrepreneurship, these results indicate that it is crucial to increase start-up activity in innovative industries to realize stronger growth rates of gross value added. The results also show that an increase in the knowledge stock in adjacent regions also affects economic growth.

## 5 Discussion and Possible Policy Implications

The findings of the empirical analyses suggest that a strongly developed regional knowledge stock is a crucial determinant of economic growth. Particularly, research and development activities in the private sector are a fundamental element of growth. R&D in the public sector also affects economic growth but the magnitude is smaller. The differences in the magnitude of the effects are not surprising. New knowledge in private firms is more likely to be translated into new products or services and more likely without delay than knowledge, which is generated in universities or research institutions. Nevertheless, research in public organizations is often characterized by fundamental research and very important for the regional or national knowledge stock. Transmission channels for this kind of knowledge could result in joint research projects or the transition of researchers into the private sector (see Arundel and Geuna, 2004 for different vehicles for private firms to assess public research). A high level of research and development is also more likely to guarantee that individuals or firms have the ability to apply and assimilate newly generated internal or external knowledge. Regions with strength in research and development activities may expect higher growth.

According to the empirical results, new firms are a vehicle to transfer and capitalize knowledge. The exploitation of entrepreneurial opportunities has a positive impact on economic growth. However, an increase in innovative start-up activity is more effective than an increase in general entrepreneurship. New firms in high-tech industries may reflect a higher quality and a higher probability of survival; therefore, these firms are more likely to contest market positions of incumbent firms and amplify innovations which lead to growth. Furthermore, a major number of entries in knowledge-intensive or technology-intensive industries could be the result of spin-

offs from existing firms, an example of employee mobility and knowledge diffusion. Especially, firms with an abundant amount of underexploited knowledge act as seed-bed for spin-offs (Agarwal et al., 2004) and are a playground for new founders (Franco and Filson, 2000).

Governments should not be misled in believing that more entrepreneurship will ultimately lead to higher economic growth. Entrepreneurship promotion policy may, however, start by stimulating entrepreneurial awareness and developing entrepreneurial skills. This is important since the discovery and evaluation of entrepreneurial opportunities go ahead the exploitation of opportunities in the entrepreneurial process. Empirical studies in the field of nascent entrepreneurship showed that only a small proportion of those, who are in the discovery and evaluation process, make the actual transition to entrepreneurship (see Davidsson, 2005 for an overview). Furthermore, founders with few assets and low quality start-ups have high failure rates and will suffer the most if they end up failing. Public policy should not focus on confidence and optimism of future entrepreneurs but rather on the quality of new firms and firms in high-tech industries. These start-ups, particularly, struggle with an imperfect financial market and are subject to financial constraints. Starting points could be, for instance, the establishment of a well-functioning venture capital market since loan capital is not their major source of financing.

**Notes**

1 Data on gross fixed capital formation (investment) are annually published by each Statistical Office of the German Federal States (series E I 6). Data on regional gross value added are published by the working group of the Statistical Offices of the German Federal States, *Volkswirtschaftliche Gesamtrechnung der Laender* biennially between 1976 and 1990 and annually since 1992

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*Table 1 Impact of entrepreneurship on regional economic growth*

| | Regional economic growth | | |
|---|---|---|---|
| | ( I ) | ( II ) | ( III ) |
| Capital | 0.111** | 0.110** | 0.111** |
| | (3.76) | (3.74) | (3.77) |
| Labor (without R&D employees) | 0.277** | 0.308** | 0.310** |
| | (6.10) | (6.51) | (6.56) |
| KNOWI (R&D employees in private industries) | 0.243** | 0.232** | 0.227** |
| | (11.88) | (11.14) | (10.83) |
| KNOWP (R&D employees in public organizations) | 0.008* | 0.007 | 0.006* |
| | (1.97) | (1.72) | (2.38) |
| Entrepreneurship (all private industries) | — | 0.025* | — |
| | | (2.28) | |
| Entrepreneurship (private industries, except knowledge- and technology-intensive) | — | — | 0.004 |
| | | | (0.28) |
| Entrepreneurship (technology- and knowledge-intensive industries) | — | — | 0.020* |
| | | | (2.38) |
| Knowledge stock adjacent regions (possible spillovers from adjacent regions) | 0.338** | 0.338** | 0.331** |
| | (14.71) | (14.76) | (14.29) |
| Constant | –0.045** | 0.141** | 0.015 |
| | (4.09) | (12.70) | (1.39) |
| $R^2$-adjusted | 0.8380 | 0.8388 | 0.8393 |
| F-Value | 64.54 | 64.09 | 63.55 |
| Observations | 959 | 959 | 959 |

*Notes*: ** significant at 1%-level, * significant at 5%-level, t-values in parentheses, regressions include regional dummies, which are here not reported.