

**The Use of Global Entrepreneurship Monitor Data in Academic Research:  
A Critical Inventory and Future Potentials**

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# **The Use of Global Entrepreneurship Monitor Data in Academic Research: A Critical Inventory and Future Potentials**

## **Abstract**

We systematically review all 109 empirical, peer-reviewed journal articles which are based on the Global Entrepreneurship Monitor's (GEM) adult population survey data. GEM has become a major database for internationally comparative entrepreneurship research because it is unique and allows investigating research questions that could not have been addressed before. Our research objectives are threefold: First, we analyse how researchers currently use GEM data in empirical academic research. To do so we apply an analysing framework that includes data source, level of analysis, variables, methods, measurement schemes, and analytical procedures. Second, we identify best practices and problematic fields of application. Third, we develop suggestions for the future design and use of GEM data. We distinguish between implications for researchers working with existing GEM data and implications for people responsible for the collection of new GEM data, i.e. the national GEM teams and the coordination team.

## **Keywords**

Global Entrepreneurship Monitor; GEM; entrepreneurial activity; empirical research

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# 1 INTRODUCTION

The Global Entrepreneurship Monitor (GEM) constitutes the single largest program to systematically research the prevalence, determinants, and consequences of entrepreneurial activity on an international level. Since its inception over one million telephone interviews have been conducted in 85 different countries to gather primary data on entrepreneurial activity; that is an equivalent of about 20 man-years of continuous interviews, assuming that an interview lasted two minutes on average.

The GEM research project was designed as a long-term multinational endeavour with the purpose of providing a database to study the complex relationship between entrepreneurship and economic growth (Reynolds, Hay, and Camp, 1999) and facilitating evidence-based policies that enhance entrepreneurship (Reynolds et al., 2005). GEM collects internationally comparable data on entrepreneurial activity in more than 50 countries in the world. It is a unique database because (1) there is no other source for comparable data on entrepreneurship from so many different countries, (2) unlike existing national statistics GEM captures all kinds of entrepreneurial activities and (3) GEM captures start-up efforts at a very early stage, i.e. nascent entrepreneurship, as well as new and established businesses.

GEM was started as and still sees itself as a policy research project aimed at measuring and describing entrepreneurial activity rather than testing any particular theoretical concepts. As such, it has been enormously successful (Davidsson, 2006, p.46). The project has had a major impact on policy making and public opinion. Results generated with GEM data were published in a series of global, national, and special topic reports. These reports have greatly contributed to our understanding of the nature and extent of start-up

activities around the world (Davidsson, 2005). While in the first years of its existence results from the GEM project were mainly published in these reports, more and more researchers are today using GEM data for more sophisticated, theory-based analyses in entrepreneurship research. The dataset has opened promising research avenues for entrepreneurship scholars, not only for researchers directly involved in the GEM project but for entrepreneurship researchers in general.<sup>1</sup> For example, analyses on the impact of the national institutional environment or culture on the extent and quality of business start-ups would not be possible without the GEM dataset, which has become a major basis for internationally comparative entrepreneurship research (Acs, Desai, and Klapper, 2008, OECD, 2009).

The importance of this database is also reflected in the increasing number of GEM-based articles in scholarly journals. Because of the growing number of countries involved and the uniqueness and richness of the GEM data, research opportunities are still abundant and will even increase over time with yearly data collections.

However, the GEM data set is extensive and using GEM data for empirical research brings about specific challenges. In the relatively young field of entrepreneurship, methodological issues are a general concern. Several authors called for more sophisticated analysis and more rigorous methods in entrepreneurship research (Chandler and Lyon, 2001; Crook et al., 2010; Dean et al., 2007; Low and MacMillan, 1988). Ireland, Webb, and Coombs (2005) identify a lack of theoretical underpinnings and methodological challenges regarding sampling, measurement, time frame, and effect size in entrepreneurship research. Concerning GEM data, researchers have mentioned concerns about the usage of GEM data for micro level analysis (Davidsson, 2006), the usage of dichotomous variables (Koellinger and Minniti, 2006), and the transferability of the

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<sup>1</sup> After a three year time lag GEM data is placed in the public domain and made available to everybody.

questionnaire from developed to developing countries in terms of content and validity (Rosa, Balunywa, and Walter, 2005).

A recent study authored by Amorós, Bosma, and Levie (2011) analyses the theoretical and empirical contributions of the GEM project, including the quantity and quality of academic articles using GEM data as their main or complement source. The authors also track the development of measures over time and hence provide valuable information about the impact and the development of the GEM project. However, the paper does not analyse the research methodology employed by scholars using GEM data and to our knowledge there is no review available that systematically reviews the methodological opportunities and challenges of the data set.

In this article we therefore analyse how GEM data is currently used in empirical academic research. In particular, we address the following research questions: (1) How do researchers currently use GEM data in academic research in terms of level of analysis, variables, methods, measurement scheme, and analytical procedures? (2) What are best practices and problematic fields of application? (3) How can future studies use the GEM database to its full potential? We hope to contribute to the awareness of the opportunities and challenges emerging from the characteristics of the data set and thus support the sound usage of GEM data to create knowledge which advances the field of entrepreneurship research. While we do not attempt to decide on the level of an individual contribution whether or not the chosen research approach and method is appropriate or not, we aim to provide an overview of designs and methods used to analyse GEM data, highlight approaches which seem promising and point out potential challenges with regard to the GEM data. For reasons of length our study does not focus on the results or the contribution to the literature of studies using GEM data in empirical research.

Our study proceeds as follows: Since the quality of the data and the options for conducting research critically depend on the collected data, we will first provide an overview of the GEM project and the main sections of the GEM questionnaire. We then describe the conceptual framework which we established in order to analyse the selected contributions systematically. Our framework has been adapted from Chandler and Lyon (2001), arguably the most influential recent analysis of methodological issues in mainstream entrepreneurship literature. We slightly adjust their framework to research based on GEM data. Afterwards, we present our findings regarding the usage of GEM data in empirical scholarly research. We discuss implications of our findings where we distinguish between users of existing data and researchers directly involved in the project who are responsible for future data collections.

## **2 The Global Entrepreneurship Monitor as a Research Program**

The Global Entrepreneurship Monitor (GEM) research program was initiated in 1997 to address the problem that national statistics on newly established firms were not internationally comparable. There were no harmonized cross-national data available, causing severe gaps in empirical entrepreneurship research (Sternberg and Wennekers, 2005). GEM provides the empirical basis for internationally comparative studies by assembling relevant harmonized data in the form of representative household surveys on an annual basis. The aims of GEM are to measure differences in the level of entrepreneurial activity among countries, to uncover factors determining national levels of entrepreneurial activity, and to identify policies that may enhance the national level of entrepreneurial activity (Bosma and Levie, 2010, p.8). At the beginning of the project another aim was to examine the impact of entrepreneurship on economic growth, as postulated in the GEM model (Reynolds et al., 2000). A pilot data collection project was carried out in

1998 with five participating countries. In the following years this number increased continuously and in 2010, 59 countries participated.

To secure international comparability, GEM collects primary empirical data in a standardized way. There are three main data sources: First, the Adult Population Survey (APS) provides standardized data on entrepreneurial activities and attitudes within each country. Second, the National Expert Survey (NES) investigates the national framework conditions for entrepreneurship by means of standardized questionnaires and, third, qualitative face-to-face interviews (National Expert Interviews) are being conducted to get a deeper understanding of strengths, weaknesses and major issues regarding entrepreneurship in the respective country (for a detailed description of data collection methods, see Reynolds et al., 2005). Clearly, the APS is the more important and more widely used data source. Therefore, we focus our analysis on articles based on this source.

Given the aims of the project, the most important issue has always been to get precise estimates of national entrepreneurship prevalence rates. The GEM APS aims to be a representative population survey and is, therefore, usually conducted as a telephone survey or a face-to-face survey. The national GEM teams have to cover the costs of this survey. Therefore, there are limits to the length of the questionnaire and mostly single-items are used. Maula, Autio, and Arenius (2005, p.473) put it this way: "Because of its emphasis on national representativeness, the GEM consortium has had to trade sample size for the breadth and depth of empirical measures."

Overall, the questionnaire and the single items are structured and formulated in a way to allow for application in a broad spectrum of countries and cultures (Reynolds et al. 2005). As a global research project the aim is to collect representative data in as many countries as possible. This can only be done by keeping the questionnaire relatively short and avoiding answer options that might lead to translation errors or cultural biases

which is a major reason for using binary (yes/no) responses. Including lengthy multi-items scales would also reduce the completion ratio and might lead to a non-response bias. While this approach has helped to increase the number of participating countries from ten countries in 1999 to 59 in 2010, the drawback is a questionnaire that only asks for little information from the single respondent and does not meet the highest scientific standards for some of the measures (Acs and Varga, 2005; Davidsson, 2006; Levie and Lerner, 2009). This has clear implications for the use of GEM data which we will outline below.

As our main concerns are the current use and the future potentials of GEM data, it is important to look at the issues covered in the GEM APS. Over time, a number of new questions were added to the questionnaire and others were changed or dropped. However, the main structure of the APS questionnaire has remained unchanged since the year 1999. Reynolds et al. (2005) describe the interview structure of the GEM 2003 APS that to a large extent is still valid today. In 2006, a new section on former self-employment was introduced. At present, the questionnaire consists of five sections:<sup>2</sup>

**Section 1 on screening items and perceptual variables.** Section 1 includes questions for all respondents. Screening items concerning entrepreneurial activity are included in this section, i.e. whether people are currently trying to start a new business, are the owner-manager of a company, expect to start a business, are active as an informal investor, or have shut down or quit a business they owned and managed. People who say “yes” (or “don’t know”) to one or more of these items will be directed to the corresponding follow-up section 2, 3, 4, or 5 which ask further questions about this entrepreneurial activity. Thus, these screening questions are of great importance because they determine who is considered a nascent entrepreneur, business owner-manager, informal

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<sup>2</sup> In recent years, the APS questionnaire in some countries included a few additional questions on specific topics like Education and Training, Social Entrepreneurship, and Family Business which we cannot describe in detail here.



investor, or former business owner-manager. Reynolds (2009) demonstrates the impact of slight changes in the wording of these screening items on the identification of nascent entrepreneurs.

This section also contains perceptual statements concerning entrepreneurship, e.g. "Fear of failure would prevent you from starting a business." All items in Section 1 are dichotomous, i.e. they only require yes/no answers. While this seems straightforward to avoid translation errors and cultural biases and to also limit the cost of the survey, measurement has been criticized from different sides (e.g. De Clercq and Arenius, 2006; Koellinger, 2008).

**Section 2 on nascent entrepreneurial activity.** Section 2 entails questions for respondents who are currently trying to start a new business. The section contains some questions concerning the founder himself (e.g., reason for starting the business, previous entrepreneurial experience) and many questions about the nature and form of the business (e.g., the year of first income/payments, kind of business, perceived innovativeness).

**Section 3 on existing businesses.** Section 3 is directed at owner-managers of existing businesses irrespective of the age of the company. The questions in this section are similar to the ones in Section 2 with the main difference being that they refer to existing businesses. If a person is currently trying to start a new business as well as the owner-manager of an existing company, this person has to answer both sections which applies to 5 to 10 percent of the respondents.

**Section 4 on informal investment activity.** Section 4 is aimed at people who work as informal investors. This relatively short section contains questions about the amount of money invested, the relationship with the person that received the investment, the expected payback amount and the expected payback time.

**Section 5 on previous entrepreneurial activity.** Section 5 is directed at people who gave up or quit a business in the previous twelve months. Respondents are asked whether the business still exists and why they closed down or quit the business. Again, this section is very short. In addition to these 5 sections, some socio-demographic information is gathered of all respondents. GEM data is collected on the basis of this questionnaire. A thorough understanding of the questions and the skip pattern is important for a meaningful analysis of the data.

### **3 METHODOLOGY AND FRAMEWORK**

We applied a structured literature search and compiled an overall inventory of 109 articles. We only selected empirical studies which use data from the GEM APS. The focus is on contributions written in English and published in academic journals from the beginning of the GEM program in 1999 until the end of 2010. We only included articles from peer-reviewed journals, as they can be considered to convey the most scientifically validated knowledge with the highest impact in the field (Podsakoff et al., 2005). In contrast to other literature reviews of this kind (Boyd, Gove, and Hitt, 2005; Grégoire, Corbett, and McMullen, 2011), we considered contributions from SSCI and non SSCI-ranked journals. GEM is an international project and thus articles are published in different parts of the world while SSCI rankings tend to have an Anglo-American bias (Andersen, 2000).

To build our database we proceeded as follows: A list of GEM-based articles provided on the GEM consortium's website served as the starting point of our literature research. It was complemented by an EBSCO search in academic journals, using the key words *GEM* and *Global Entrepreneurship Monitor* in the abstract and/or the title. We then selected all articles which used data from the GEM's APS section for conducting own

empirical research. We excluded empirical studies which only used data from the expert survey as well as conceptual contributions concerning the methodology or the model underlying the GEM project. We also did not consider studies which merely referred to some key figures of the GEM project without conducting own data analyses. Our search left us with a list of 109 articles that met our above mentioned selection criteria. The complete list of articles is provided in Table 1. The table also provides information about the level of analysis, the topic, and the dependent variable of the respective study.

In a first step we analysed the publication outlet and the principal topics of each study. For the latter, we attributed each contribution to one or more subject-matter areas without using any pre-defined categories. Instead, we let the topics emerge from the data. We distinguished twelve different topics: formal institutions, informal institutions, women entrepreneurship, attitudes and perceptions, financial aspects, regions, networks, economic growth, business growth, internationalization, innovation, GEM methodology.

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INSERT TABLE 1 ABOUT HERE  
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In a second step we focused on the research design of the studies. To ensure a reliable evaluation of the contributions we set up an analytical framework adapted from Chandler and Lyon (2001) including relevant aspects of data usage in empirical studies. The framework was revised throughout the process. In revising the framework we also considered feedback provided by experts from the GEM team. The analysis itself was conducted as following: Each article was coded according to the analytical framework by two of this article's authors independently. The level of agreement was acceptable (95.4 percent of initial codes), and any discrepancies were resolved through discussion. Were necessary, changes to the original results of the analysis were made after discussing the

respective items. The framework consists of eight building blocks as presented in Figure 1.

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INSERT FIGURE 1 ABOUT HERE  
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#### **4 Publication Output and Outlets**

The first publication in an academic journal based on GEM APS data appeared in 2003. In subsequent years, the number of publications rose to 25 in 2007 and has levelled off at around 15 contributions since (Table 2).

Academic articles using GEM data have been published in a number of different journals. However, one journal clearly stands out: 25 articles (almost one quarter of all identified articles) have been published in Small Business Economics Journal, largely in special issues devoted to GEM-based research. Other highly-ranked entrepreneurship journals appear less frequently on the list: International Small Business Journal (5 articles), Entrepreneurship and Regional Development (4), Entrepreneurship Theory and Practice (3), Journal of Business Venturing (2), Strategic Entrepreneurship Journal (1). So far, no GEM-based article has appeared in the Journal of Small Business Management.

Overall, 53% of all identified GEM publications appeared in SSCI-listed journals (Table 1). While in 2003 and 2004 there were hardly any GEM publications in SSCI listed journals, this has clearly changed in recent years.

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INSERT TABLE 2 ABOUT HERE  
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The number of articles in a given year is influenced by the existence of a special issue for publications based on GEM data. We could identify five such special issues<sup>3</sup>. Altogether, about 30% of all publications based on GEM data appeared in special issues. From 2003 to 2005 only five GEM data based articles (of 22 in total) were not published in special issues. Thus, special issues played an important role in introducing and establishing the use of GEM data in journal publications. The recent downward trend in the number of publications can be attributed to the fact that no such special issue was published in 2009 and 2010.

## 5 RESULTS ON THE USE OF GEM DATA

In line with our analysing framework, the structure of this chapter is adapted from Chandler and Lyon (2001).

### 5.1 Data Sources

This contribution only considers articles based on GEM data. Frequently, however, empirical articles do not only use data from a single but from different sources, as is also common practice in GEM-based research. Overall, 35% of all articles are solely based on GEM data, whereas 65% combine GEM data with data from other sources. GDP per capita, the unemployment rate, the ease of starting a business, and other macro level

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<sup>3</sup> Small Business Economics (2005), Vol. 24, No. 3, with 9 articles based on GEM data; Small Business Economics (2007), Vol. 28, No. 2/3, with 8 articles based on GEM data; Small Business Economics (2008), Vol. 31, No. 3, with 5 articles based on GEM data; International Journal of Entrepreneurship and Small Business (2004), Vol. 1, No. 3/4, with 8 articles based on GEM data; Estudios de Economía (2008), Vol. 35, No. 2, with 4 articles. In some cases the special issues contain papers that describe the GEM model or the methodology but do not use GEM data for empirical research. These papers and the introductions to the special issues are not counted here.

data from the World Bank, OECD, or other sources are frequently used in the contributions analysed.

The nature of GEM data allows adding data on the macro level but not on the micro level. If national GEM teams want to obtain further information on the micro level that is not included in the standard GEM questionnaire, they have to include additional questions in the APS when collecting the data. Even considering the fact that country teams have to cover the costs for this by themselves, it is still surprising that so far only few countries seem to have taken advantage of this possibility. Denmark, New Zealand, and the United Kingdom have added questions concerning networks, training, ethnicity of the founder, and location and performance of the business and have used this data for journal publications.<sup>4</sup> A good example for this type is the analysis of Roper and Scott (2009), who investigate perceived financial barriers and the start-up decision. Thompson, Jones-Evans, and Kwong (2009) use one additional question to the standard GEM questionnaire (whether business is home-based or not) to show that women with poor level of resources are more likely to run their business from home. As GEM captures entrepreneurial activity of all kind, it seems highly appropriate to use it to investigate a research question of this kind. Levie and Lerner (2009) investigate resource mobilization and performance of family and non-family firms in the UK based on an extended GEM survey that also includes questions on business performance and characteristics of the owner/manager. Conducting a stand-alone survey on this topic would be much more costly than adding a limited number of questions to the GEM survey, which identifies a representative sample of nascent or active business owners anyhow.

Altogether we identified 17 articles (16% of all articles) that use data from additional questions added by national teams. However, these data are collated from only three

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<sup>4</sup> We are not able to provide a list of all countries that have added additional questions but can only name those countries that have used the data from additional questions for journal publications.

countries, indicating the potential of extending the GEM questionnaire for specific research purposes. The additional costs of adding questions which have to be covered by the national teams can be comparably low when these only go to a sub-group of the whole sample.

## 5.2 Variables Used

### **Dependent variable**

To increase our knowledge about relationships between different phenomena quantitative research usually distinguishes between one (or more) dependent variable(s) and a set of independent variables, the assumption being that the independent variables influence or determine the dependent variable(s). Given the substantial number of variables in the GEM data set, it is worth knowing which variables are used in what way in statistical analyses.

As expected, the great majority of articles try to explain some form of entrepreneurial activity. Only a few contributions use entrepreneurial intentions or entrepreneurial perceptions, attitudes, or networks as the dependent variable (Table 3).

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INSERT TABLE 3 ABOUT HERE  
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However, a closer look at the variables used reveals that in most cases the measures nascent entrepreneur, young business owner-manager and the combination of both, total early stage entrepreneurial activity (TEA) are being used. GEM APS captures all kinds of entrepreneurial activity including any type of self-employment (full-time and part-time) and being an owner-manager of an established firm. Only few articles use this part of the database, i.e. data on established firms. Also, users of GEM data should be aware that nascent entrepreneurship and young business ownership are of a different quality.

Longitudinal studies show that only about 30 to 60 percent of all nascent entrepreneurs become owner-managers of a business one year later (Bergmann and Stephan, 2012). Reynolds and Curtin (2008, p.265) report that approximately one third of all nascent entrepreneurs in the U.S. pursue start-up efforts without a serious intent on starting an operating business. Thus, combining nascent entrepreneurs and new-business owner managers in one measure of entrepreneurial activity, as it is currently done with TEA, might not be justified. The GEM consortium could consider adding questions to the questionnaire about what activities nascent entrepreneurs have done, to get a deeper understanding of this concept in a cross-country perspective (Bird and Schjoedt, 2009).

As Crook et al. (2010) stress the importance of having an adequate fit between the research design and the method and measures used in entrepreneurship research, one can also raise the question whether the frequently used measures of entrepreneurial activity defined and calculated by the GEM coordination team are appropriate for all different research questions. GEM captures all kinds of entrepreneurial activity including self-employment and part-time activities while many entrepreneurship theories refer to Schumpeter-type innovative, growth oriented start-up activities. On the basis of the micro data, researchers can calculate other measures of entrepreneurial activity that may better suit their particular research question. For example, Bergmann and Stephan (2012) calculate a modified new business owner-manager rate that captures only very recent start-up attempts because it better fits their research design.

National economic growth is the central dependent variable in the GEM model (see



Figure 1) and, at the outset of the project, one aim was "to study the complex relationship between entrepreneurship and economic growth" (Reynolds et al. 2000, p.1). Against this background it is surprising that so far only five articles use GEM data to examine the influence of entrepreneurial activity on economic growth or another external variable (Acs and Varga, 2005; Galindo Martin, Méndez Picazo, Alfaró Navarro, 2010; Wennekers, 2005; Valliere and Peterson, 2009; Wong, Ho, and Autio, 2005). There are some articles on the relationship between the level of economic development (usually measured in terms of GDP per capita) and entrepreneurial activity (Baughn, Chua, and Neupert, 2006; Minniti, 2010; Stephan and Uhlaner, 2010; Wennekers et al., 2005). However, these articles regard entrepreneurial activity as depending on the level of development and not the other way around.

One can assume that there is some kind of time-lag between entrepreneurial activity and economic growth. Results for German regions suggest that the effect of new business formation on employment is greatest after approximately seven years (Fritsch and Mueller, 2008). So far, GEM data based studies have not thoroughly taken account of such time lags or tried to estimate their duration. Thus, there is still potential for further analysis in this field.

### **Independent variable**

A substantial variety of variables has been used as independent variables in the existing GEM studies. In models explaining entrepreneurial activities, entrepreneurial attitudes and perceptions frequently act as independent variables (De Clercq and Arenius, 2006; Driga, Lafuente, and Vaillant, 2009; Kwon and Arenius, 2010). Presumably, these items are frequently used because they are part of section 1 of the questionnaire and are thus answered by all respondents. However, already in 2005 Arenius and Minniti (2005, p.243) point out: "The data, unfortunately, does not allow us to establish the causal di-

rection of the relationship.” The reason for this is straightforward: GEM is based on cross-sectional surveys and entrepreneurial activities and entrepreneurial perceptions are measured at the same time. It seems reasonable to assume that positive entrepreneurial perceptions increase the likelihood of starting a business. However, being involved in starting a business might also improve the perception of one's abilities, opportunities, and the acquaintance with other entrepreneurs. So far, this issue has not been solved completely. Recent studies have tried to avoid this issue by including these perceptual variables not on the micro level but only as regional or national rates (Bosma and Schutjens, 2011), which alleviates the causality problem. Overall, it is certainly unsatisfactory that many journal contributions completely ignore the possible reciprocal relationship between entrepreneurial activities and perceptions.

So far, only few studies have looked at the determinants of positive entrepreneurial attitudes and perceptions (Bosma and Schutjens, 2011; Kwon and Arenius, 2010) and certainly more should be done in this area.

### **5.3 Level of Analysis**

More than two decades ago Low and MacMillan (1988) observed that the success of the individual enterprise will be affected by factors that can only be observed at different levels of analysis. Referring to Davidsson and Wiklund (2001, p.82) we define level of analysis as the "hierarchy of aggregation of data". All GEM APS data were collected on the micro level. However, it is common to aggregate individual data to regional or national values, usually rates, i.e. macro-level variables.

For articles using bivariate or descriptive analysis techniques the level of analysis is often difficult to determine because there is no clear dependent variable and the articles

work on different levels of analysis. More than 70% of the articles use some kind of multivariate analysis technique. Focusing on these articles we can clearly distinguish between two broad groups of articles: The first group of articles work on the micro level, i.e. with the individual data of the APS. The other group of articles works on the macro level, i.e. with aggregated rates of entrepreneurial activity, intentions, attitudes, or characteristics, e.g. the TEA rate or the nascent entrepreneurship rate for countries or regions.

Of the 80 articles using multivariate analysis techniques, 40 articles work on the macro level, 37 on a national level and only three on a regional level (Sternberg and Litzenberger, 2004; Naudé et al., 2008; Rocha and Sternberg, 2005), and 40 articles on the micro level. Thus, there is no clear trend and we do not find support for Klyver's (2008) observation that there are only few studies that analyse GEM data on the micro level.

Davidsson (2006, p.45) argues that GEM data can lead to unique new insights, “especially if combined with data from other sources on other country characteristics“. For two reasons, combining GEM with other data is a fruitful way of using this data set. First, entrepreneurship is a multilevel phenomenon which should be taken account of in research designs (Low and MacMillan, 1988). GEM collects data on entrepreneurial activity on the micro level and makes it available in this form. This is an immense advantage in comparison to other publicly available data sets that only give accumulated numbers for regions or other entities. By using micro-level information about the founder and the (nascent) business and combining it with external data on the regional, national, or industry level, multilevel studies are possible. Second, because of the limited length of the APS questionnaire explained above, only certain topics can be covered. Adding data from other sources can help to overcome this restriction. So far, most studies of this kind added data on the national level and only seldom on the regional

level. We do not know of any study that has added industry-specific data. Altogether, there are 18 multivariate articles that work on the individual level and add data from other sources on the macro level, i.e., doing a multilevel analysis. This accounts for 17% of all articles based on GEM data. Thus, the share of multilevel analyses is larger than on average in entrepreneurship research (Davidsson and Wiklund, 2001).

Some authors argue that attempts to use GEM data on the micro level have been less successful and that GEM data should mainly be used on the macro level (Davidsson 2006, p.45). This claim might hold for pure micro level analyses but not for multilevel analyses, where the dependent variable is micro level and the independent variables are from the micro and the macro level.

Kwon and Arenius (2010) provide an excellent example of a multilevel analysis that combines micro data from the APS with macro level data from the APS and other sources in a single analysis. Their analysis looks at opportunity perception and weak-tie investment as dependent variables. They acknowledge that both phenomena occur at the individual level but that they are embedded in the societal context and, thus, are shaped by social capital. Consequently, they take a multilevel approach combining micro level GEM data with national data on social capital from the World Values Survey (WVS) and other country-level data. Other examples of well-developed multilevel analyses include Acs and Autio (2010), Bergmann and Sternberg (2007), and, more recently, Bosma and Schutjens (2011) and Bergmann (2011).

## **5.4 Hypotheses-Driven Research**

Before the GEM project, there were no comparable data that could be used to describe and analyse (nascent) entrepreneurial activity in an international perspective. GEM

filled this gap, greatly increasing our understanding of the extent and characteristics of entrepreneurship. While a comprehensive description of a phenomenon is an important step towards understanding it, this is not deemed sufficient in scholarly research. Theory-driven research is considered an essential attribute of high-quality research, nonetheless there is evidence that in entrepreneurship research this quality standard has not always been applied, a fact that led Low and MacMillan (1988, p.155) to demand that the field of entrepreneurship move to a level where studies that are “not theory driven and do not test hypotheses are no longer acceptable”. Searching for correlations in a large data set such as the APS data without a set of hypotheses based on prior research might be problematic because of the risk of finding significance merely due to the large number of possible relationships (Edmondson and McManus, 2007). We therefore analyse whether or not the studies test previously conceived hypotheses, taking hypotheses testing as a proxy for research that is theory-driven. In our sample, 52% of the articles do so, including work that empirically tests “propositions” or “theorems”. Considering the fact that our sample only comprises articles based on a large quantitative data set which is well-suited for hypotheses-driven research in a mature stream of literature (Edmondson and McManus, 2007; Molina-Azorin et al., 2012), this number is surprisingly low. However, considering only articles published in the *Journal of Business Venturing* and *Entrepreneurship Theory & Practice*, arguably the most influential journals in the field (Chandler and Lyon, 2001), all of them test hypotheses derived from the literature, suggesting that this is a necessary condition to be accepted in these outlets.

However, when researchers test hypotheses on the basis of GEM micro data they should be aware that – because of the usually large sample size – small effects are likely to be significant (Hair et al., 2006). Thus, researchers should always evaluate the economic significance of an effect and report the overall explanatory power of their model.

## 5.5 Measurement Schemes

As mentioned above, the most important aim of GEM is to get valid and reliable estimates of the national level of entrepreneurial activity. The procedures for estimating national entrepreneurial activity are based on previous research endeavours, including the first Panel Study of Entrepreneurial Dynamics (PSED), and have been refined over the years (Davidsson, 2005). The validity and reliability of these measures is discussed in Reynolds et al. (2005) and meets contemporary standards. As GEM data collection takes place as a survey, the reliability of the entrepreneurship prevalence rates depends on the sample size. To ensure a high accuracy of these measures, GEM demands a minimum sample size of 2000 respondents in the APS. However, as mentioned above, to limit the costs of a representative survey of this size, the overall length of the questionnaire is rather short. This is achieved by using single-item measures or dichotomous measures for most of the other constructs under investigation, like perceptual variables and characteristics of the business. This procedure seems well suited if a measure is to be administered to a wide range of different populations, as is the case in the GEM project (Fuchs and Diamantopoulos, 2009). However, as measurement schemes are of vital importance to the research process and single-items are widely assumed to have inadequate psychometric properties (Boyd, Gove, and Hitt, 2005), scholarly researchers are mostly discouraged to use such measures. Editors and reviewers of academic journals are reluctant to accept articles using single-items (Fuchs and Diamantopoulos, 2009; Wanous, Reichers, and Hudy, 1997), as multiple-item measurements are generally considered to better fulfil psychometric requirements and hence to yield more reliable and valid results (Sarstedt and Wilczynski, 2009). As poor construct measurement has been found to be among the most important sources of distorted findings, and as variables of interest in management research are complex and unobservable, the need for the estab-

lishment of reliability and validity has been accentuated for management research in general and for entrepreneurship research in particular (Boyd, Gove, and Hitt, 2005; Chandler and Lyon, 2001; Crook et al., 2010; Short et al., 2009).

Only little more than 10% of the articles in our sample were explicit about how they secured the reliability of their measures. Throughout the sample, 50% of the articles refer in any way to Reynolds et al. (2005) who tested the reliability of measures of entrepreneurial activity. Still, psychometric properties of other measures from the APS have not been established so far, a point which is rarely mentioned in the articles reviewed.

Furthermore, it is widely asserted that single-item measures lack validity because they tend to insufficiently capture the conceptual domain of a construct (Fuchs and Diamantopoulos, 2009). However, only 16% of the articles in our sample paid attention or at least mentioned validation procedures beyond face validity.

Several authors in our sample use single-items from the APS to measure constructs that have been captured by multi-item measures in prior research, like risk preferences (e.g., Koellinger 2008), self-efficacy (e.g., Stephan and Uhlaner, 2010), or networking (e.g., Klyver and Hindle, 2007). As is mentioned in some of these articles, an in-depth analysis of the psychometric characteristics of these single-items (as compared to multi-item measures) or the use of validated survey items might be needed to increase quality and significance of the findings (De Clercq and Arenius, 2006; Koellinger, 2008).

Furthermore, there are inconsistencies among researchers concerning the use of measures from the GEM data set as proxies for different constructs. For example, the answer to the item “You know someone personally who has started a business in the past 2 years” has been used both as a proxy for entrepreneurial networking (Klyver and

Hindle, 2007; Klyver, Hindle, and Meyer, 2007) and for exposure to external knowledge (De Clercq and Arenius, 2006) alternatively.

However, there are ways to deal with these measurement issues since single-item measures may, under certain circumstances, also have acceptable psychometric characteristics. For example Wanous and Hudy (2001) show that reliability for single-items can be estimated. They suggest different procedures to compute reliability measures. Previous research has also pointed to the fact that “one or two *good* items that elicit *appropriate* respondent behaviour will yield better *information* than multiple, poorly presented items that increase the error term correlations and/or stimulate inappropriate response styles” (Drolet and Morrison, 2001, p.199, original emphasis). As APS data is used to approximate different constructs from the literature, an avenue for future research could be to include GEM APS items and established multi item measures in the same survey in order to compare the reliability and validity of the GEM measures (e.g., Wanous and Hudy, 2001; Wanous, Reichers, and Hudy, 1997).

## 5.6 Statistical Procedures

To capture the statistical procedures used in the studies, we applied a category scheme similar to the one applied by Chandler and Lyon (2001). Table 4 provides an overview of the statistical procedures matched with the dependent variables of the respective contribution.

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INSERT TABLE 4 ABOUT HERE  
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The contributions in our sample mainly use descriptive statistics, regression analyses, correlation analyses, logistical regression/logit, probit, or comparisons of means as sta-



tistical methods. More advanced statistical methods such as factor analysis, cluster analysis, or SEM were used less often. This is mainly due to the nature of the GEM data itself, largely consisting of single-items or dichotomous measures.<sup>5</sup>

Another issue related to GEM data that affects the application of statistical procedures are “rare events”. Nearly 40% of all contributions use one of the measures for entrepreneurial activity on the micro level as dependent variable (e.g. nascent entrepreneurs). Since in a representative population survey there are only few entrepreneurs compared to non-entrepreneurs in developed countries, entrepreneurial activities can be considered a “rare event” and standard estimation techniques might generate biased results (King and Zeng, 2001).<sup>6</sup> The potential bias in the coefficient depends on the sample size and the occurrence of the events and can be regarded as a “smooth transition” rather than a black-and-white decision. To deal with this issue King and Zeng (2001) provide a method for calculating estimates in logit models that correct for the bias caused through rare events. The method is labelled *Rare Events Logistic Regression*, or *ReLogit* and has already been used to analyse GEM data (De Clercq and Arenius, 2006; Lafuente, Vaillant, Rialp, 2007; Vaillant and Lafuente, 2007). However, as this statistical technique also has some limitations, other approaches might as well be used to deal with rare event issues (Levie 2007).

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<sup>5</sup> Nevertheless, we identified one article that applies SEM to analyze GEM data. Justo et al. (2008) provide an alternative measure for entrepreneurial activity which takes into account two latent continuous variables: the individual’s entrepreneurial propensity (measured by four GEM indicators) and the individual’s social entrepreneurial environment (measured by three GEM indicators). In this way the authors are able to construct a continuous latent variable and apply a SEM procedure.

<sup>6</sup> King and Zeng (2001: 138) provide the following definition for rare event data. A rare event is a “binary dependent variable[s] with dozens to thousands of times fewer ones [...] than zeros (‘nonevents’)”.

## 6 SUGGESTIONS FOR THE FUTURE DESIGN AND USE OF GEM DATA

In this article we provide an overview and analysis of how GEM data is currently used in academic research. By analysing over 100 empirical contributions we are able to develop suggestions which are intended to help scholars expand and improve the use of GEM data. Similar to Davidsson and Gordon (2012) we distinguish between implications for researchers working with existing GEM data and implications for people responsible for the collection of new GEM data, i.e. the national GEM teams and the coordination team (Table 5).

### **Implications for Researchers using existing GEM data**

While a considerable number of articles based on GEM data has already been published there is still potential for future research. For example, some topics like innovation and internationalization have attracted only few publications so far, others have been studied quite extensively but still offer further opportunities.

Considering the availability of data for a great number of countries as well as the limited length of the GEM questionnaire, GEM data offer ample opportunities for research designs that combine GEM data with data from others sources (Davidsson 2006, p.45). This approach has been used in the majority of GEM data based publications and remains a promising avenue for future research. GEM data are ideally suited for multi-level research designs where the dependent variable is on the micro level and the independent variables are from the micro and the macro level. However, because of the specific nature of GEM data, other data can only be added on the aggregated, macro level and not on the micro level.

When investigating entrepreneurial activity most research has used one of the measures defined and calculated by the GEM coordination team, especially nascent entrepreneurship, young business ownership and the combination of both, i.e. TEA. While this approach has the advantage of using established measures that have been described and validated in other studies, we seldom found a thorough justification for the selection of the particular variable. In our view, researchers should take advantage of the availability of micro data and consider calculating their own measure of entrepreneurial activity that better suits their particular research question.

Researchers should also keep in mind that GEM captures all kinds of entrepreneurial activity, including self-employment, part-time, and informal economy activities. While some observers see this as a disadvantage (The Economist, 2011), it should clearly be considered an opportunity, because there is no other database that offers information about the whole spectrum of new business endeavours. The conference topic of the Academy of Management 2012 Annual Meeting “*The Informal Economy*” underlines the significance of this breadth of data.

Changes in the research design offer an option to broaden the scope of research. As the number of years for which data are available increases over time, accounting for a time lag when researching the influence of entrepreneurial activity on national and regional economic growth seems to be a promising research opportunity. Furthermore, the reciprocal relationship between perceptual and activity variables provides a potential research field.

We also identified challenges with regard to applied methods and measurement that researchers should be aware of. Importantly, the advancement of theory building based on GEM data would benefit from hypotheses-driven research linking the findings from GEM related research to prior findings and theoretical contributions. Additionally, re-

searchers using GEM data are required to take into account the characteristics of the provided data set. We aimed to point out some of these specifics. First, even though researchers use data generated through a standardized questionnaire, reliability and validity issues need to be addressed. While these issues have been dealt with regarding the standard measures of entrepreneurial activities (Reynolds et al., 2005; Acs, Desai, and Klapper, 2008), they also need to be considered with regard to variables whose psychometric properties have not yet been tested rigorously such as the perceptual variables provided in GEM. Ensuring reliability and validity of the measures used is a necessary precondition for publications in leading entrepreneurship and management journals. Second, researchers who use one of the measures for entrepreneurial activity on a micro level as their dependent variable should take into consideration that they might be dealing with “rare event” issues which could be mitigated by applying a suitable statistical technique.

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INSERT TABLE 5 ABOUT HERE  
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### **Implications for the national GEM teams and the GEM coordination team**

The GEM consortium, consisting of the national teams and the coordination team, is constantly improving the quality of data collection and usage. As the data set is quite extensive, scholars would greatly benefit from a code book describing the properties of the variables. Such a code book might foster the usage of the full set of variables and thus extend the boundaries of GEM-based research. The added transparency provided by a code book could also encourage policy makers and organizations such as the OECD to use the data more frequently for statistical purposes. Recently, a report on the

design, data, and quality control of the GEM has been published which will be of great help in this respect (Bosma, Coduras, Litovsky, and Seaman, 2012).

An important way to improve GEM related research by initiation of the consortium would be to demonstrate the validity of GEM measures. While the “core entrepreneurship measures” such as nascent entrepreneurs have been proven to be reliable and valid, the same level of quality cannot be ensured for other measures such as perceptual variables. Also, as mentioned earlier, single-item measures can be problematic. Comparing these measures with established multi-item measures could help to better judge the quality of these measures. If measures turn out to be problematic, the GEM consortium should consider asking different questions in future surveys. We are, of course, aware that this kind of decision comes with a trade-off between the availability of comparable data over a long time-period and the desire to increase the quality of the data set.

In recent years, GEM has adopted the policy of adding special topic questions to the questionnaire. It is too early to say whether this approach will lead to an increase in the number of published articles. However, our analysis has shown that adding additional questions on the national level alone can already greatly increase the interest in the project and the potential research output, and this at a relatively low cost. Especially for national teams which have been conducting GEM for a number of years it might be important to demonstrate that the data can be used to answer new research questions in order to ensure funding and maintain the motivation of the involved team members.

The purpose of this contribution is not to criticize prior work but to provide insights and recommendations which will help researchers improve the application of GEM data in future research projects and identify needs for future research designs in GEM related research. We therefore note our debt to all researchers who performed the work upon which this article is based. Likewise, we acknowledge the efforts which were put into

the GEM country reports, non-English articles, conference and working papers which were not part of this research.

Overall, we hope that this contribution will help to encourage an even broader scholarly community to use GEM data for academic research and make the results available to policy makers and the public.

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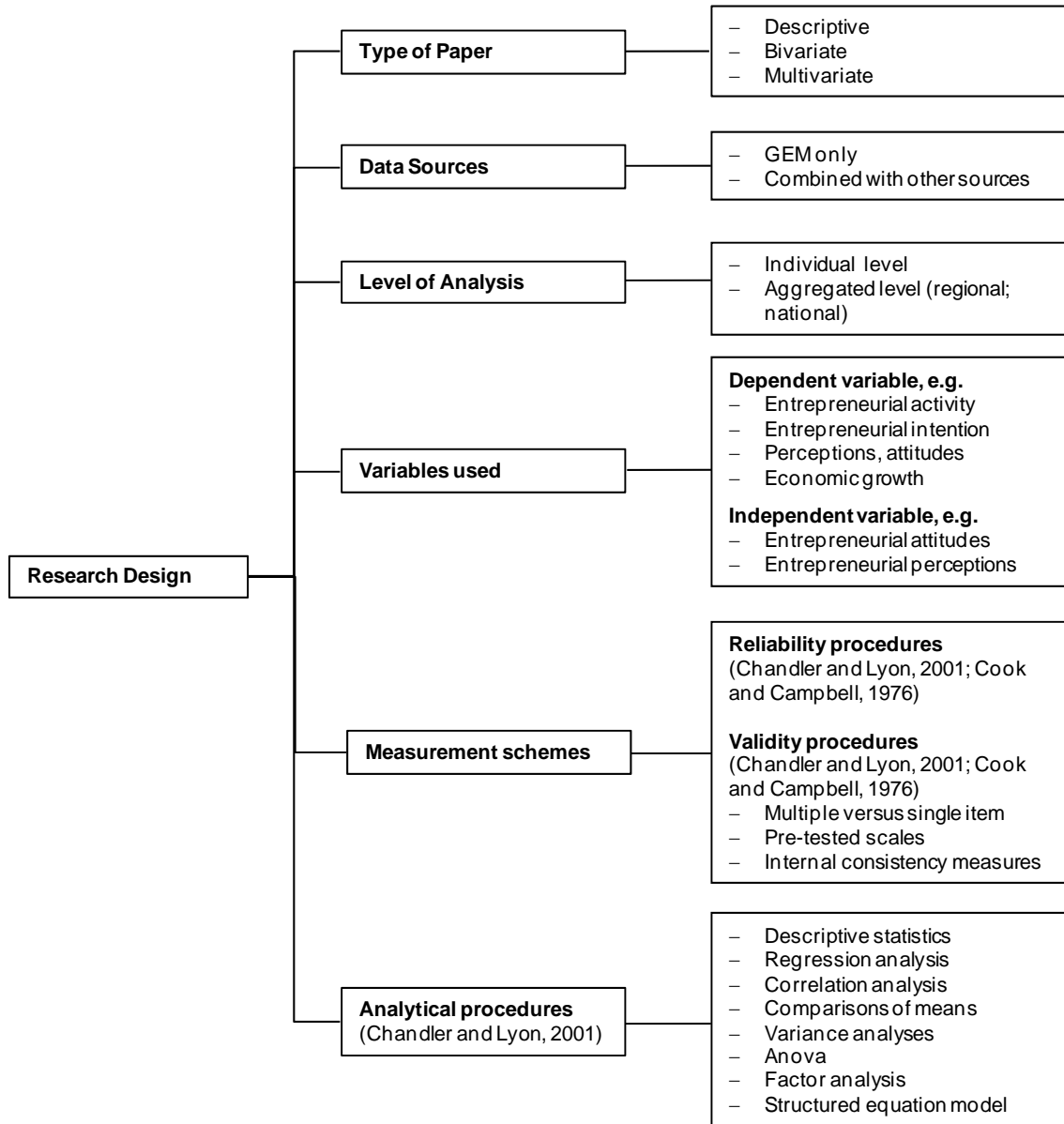
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**Figure 1: Analysing framework**



**Table 1: Analysed papers (sorted by year and by author(s))**

No.	Author(s)	Title	Year	Journal	Unit of analysis (1=ind., 2=reg., 3=nat.)	Topic: formal institutions	Topic: informal institutions	Topic: gender	Topic: finance	Topic: growth GDP	Topic: business growth	Topic: regions	Topic: networks	Topic: internationalization	Topic: innovation	Topic: psych. factors	Topic: methodology	multivariate Analysis	Dep. var.: indiv. entr. act.	Dep. var.: indiv. entr. int.	Dep. var.: indiv. entr. perc.	Dep. var.: aggr. entr. act.	Dep. var.: aggr. ndiv. int.	Dep. var.: aggr. entr. perc.	Dep. var.: external var.
1	Bygrave, W. et al.	Executive Forum: A Study	2003	VC	3				1									1							
2	de Waal, A.	Business start-ups and	2004	IJESB	3					1												1		1	
3	Eden, S.; Cruick-	New Zealand women	2004	IJESB	3			1														1			
4	Frederick, H.	Towards high growth	2004	IJESB	3						1											1			
5	Frederick, H.; By-	How we finance our new	2004	IJESB	3				1																
6	Harding, R.	Social Enterprise: The New	2004	BSR	2																		1		
7	Maritz, P. A.	New Zealand necessity	2004	IJESB	3	1																	1		
8	Maritz, P. A.	Tri-nations entrepreneurial	2004	IJESB	3	1																	1		
9	Sternberg, R.	Regional Clusters in Ger-	2004	EurPS	2						1							1				1		1	
10	Wilson, G.; Mitch-	Home-based entrepreneurs	2004	IJESB	1														1						
11	Zhu, Y. et al.	Communicating entrepre-	2004	IJESB	3		1																1		
12	Acs, Z.; Varga, A.	Entrepreneurship, Agglom-	2005	SBEJ	3					1					1			1							1
13	Arenius, P.; De	A Network-based Ap-	2005	SBEJ	1								1			1		1			1				
14	Arenius, P.; Minniti,	Perceptual Variables and	2005	SBEJ	1											1		1	1						
15	Cruickshank, P.;	Entrepreneurial gender gap	2005	JSBE	3			1															1		
16	Maula, M. et al.	What Drives Micro-Angel	2005	SBEJ	1				1										1	1					
17	Minniti, M.	An Empirical Assessment	2005	GBER	1						1								1	1					
18	Morales-Gualdrón,	The new venture decision:	2005	IEMJ	1														1	1					
19	Rocha, H.; Stern-	Entrepreneurship: The Role	2005	SBEJ	2						1								1			1			
20	van Stel, A. et al.	The Effect of Entrepreneur-	2005	SBEJ	3	1				1									1						1
21	Wennekers, S. et al.	Nascent entrepreneurship	2005	SBEJ	3					1									1			1			
22	Wong, P. et al.	Entrepreneurship, Innova-	2005	SBEJ	3					1	1								1						1
23	Acs, Z.	How is entrepreneurship	2006	Inno-	3					1															1
24	Arenius, P.; Ko-	Similarities and Differ-	2006	ISBJ	1			1								1		1	1						
25	Baughn, C. et al.	The Normative Context for	2006	ETand	3	1	1												1				1		
26	Cruickshank, P.;	Entrepreneurial Success	2006	JSBE	2								1										1		
27	De Clercq, D.;	The role of knowledge in	2006	ISBJ	1														1	1					
28	Harding, R.; Cowl-	Assessing the scale of the	2006	JSBED	1				1		1														
29	Koellinger, P.;	Not for Lack of Trying:	2006	SBEJ	1		1												1	1					
30	O’Gorman, C.;	Financing the Celtic Ti-	2006	VC	1			1	1																
31	Tominc, P.; Reber-	Growth aspirations of	2006	Mana-	1			1			1								1				1		
32	Tominc, P.; Reber-	Growth aspirations and	2006	SBEJ	3		1				1												1		

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33	Verheul, I. et al.	Explaining Female and	2006	EandR	3	1																			
34	Acs, Z. et al.	Could the Irish Miracle be	2007	SBEJ	3	1																			1
35	Bergmann, H. et al.	The Changing Face of	2007	SBEJ	1	1						1						1	1						
36	Bosma, N.; Schut-	Outlook on Europe: Pat-	2007	TESG	2							1												1	
37	Cowling, M.; By-	Entrepreneurship, Welfare	2007	CLLan	3	1												1					1		
38	Harding, R.	Understanding social en-	2007	IandH	3																			1	
39	Hessels J. et al.	Social Security Arrange-	2007	CLLan	3	1												1					1		
40	Hindle, K.; Klyver,	Exploring the relationship	2007	IEMJ	3											1		1					1	1	
41	Ho, Y.P.; Wong,	Financing, Regulatory	2007	SBEJ	3	1			1									1					1		
42	Klyver, K.	The Shifting Family In-	2007	IJEER	1								1					1	1						
43	Klyver, K.; Chris-	Exporting entrepreneurs:	2007	IJGSB	1								1	1				1				1			
44	Klyver, K.; Hindle,	The role of social networks	2007	SER	1								1					1	1	1					
45	Klyver, K.; Ter-	Entrepreneurial Network	2007	WIMR	1				1					1				1					1		
46	Koellinger, P. et al.	I Think I Can, I Think I	2007	J Ec.	1											1		1	1			1			
47	Lafuente, E. et al.	Regional differences in the	2007	Reg.	1		1					1						1	1	1					
48	Langowitz, N.;	The Entrepreneurial Pro-	2007	ETand	1				1									1	1						
49	Levie, J.	Immigration, In-migration,	2007	SBEJ	1		1											1	1						
50	Minniti, M.; C.	Being in Someone Else's	2007	SBEJ	1				1									1	1						
51	O'Gorman, C.;	Entrepreneurial Activity in	2007	Ir. J.	3																				1
52	Szerb, L. et al.	Informal Investment in	2007	SBEJ	1					1								1	1						
53	Szerb, L. et al.	Seeding New Ventures:	2007	VC	1		1			1								1	1						
54	Uhlaner, L.; Thurik,	Post Materialism Influenc-	2007	J Evol.	3		1											1						1	
55	Vaillant, Y.; La-	Do different institutional	2007	EandR	1		1					1						1	1	1					
56	van Stel, A. et al.	The Effect of Business	2007	SBEJ	3		1											1						1	
57	Wong, P.; Ho, Y.	Characteristics and Deter-	2007	VC	1					1								1	1						
58	Zinger, J. et al.	Stages of Small Enterprise	2007	J Ent.	1				1									1	1						
59	Acs, Z. et al.	What does "entrepreneur-	2008	SBEJ	3		1										1	1						1	
60	Acs, Z.; Amoros, J.	Entrepreneurship and	2008	SBEJ	3					1								1						1	
61	Aidis, R. et al.	Institutions and entrepre-	2008	JBV	1		1											1	1						
62	Amorós, J. et al.	Formal and Informal Equi-	2008	Estud.	2					1															
63	Amorós, J.E.; Cristi,	Longitudinal analysis of	2008	IEMJ	3						1							1					1		
64	Arenius, P.;	Variation in the level of	2008	Estud.	3				1														1	1	
65	Bjørnskov, C.; Foss,	Economic Freedom and	2008	Publ.	3		1											1					1		
66	Bowen, H.; De	Institutional contexts and	2008	JIBS	3		1											1					1		

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67	Coduras, A. et al.	The Relationship Between	2008	IAER	3	1						1						1	1							
68	De Clercq, D. et al.	Knowledge spillovers and	2008	SBEJ	3								1					1					1			
69	De Clercq, D.;	An Exploratory Study of	2008	JSBE	1								1					1								
70	Hessels, J. et al.	Drivers of entrepreneurial	2008	IEMJ	3	1					1					1		1				1				
71	Hessels, J. et al.	Entrepreneurial aspirations,	2008	SBEJ	3						1				1	1		1					1			
72	Justo, R. et al.	Indicators of entrepreneur-	2008	IJESB	1												1	1	1							
73	Klyver, K.	The Shifting Consultant	2008	JSBED	1								1					1								
74	Klyver, K. et al.	Influence of social network	2008	IEMJ	3		1						1					1				1	1			
75	Koellinger, P.	Why are some entrepre-	2008	SBEJ	1										1			1	1							
76	Levie, J.; Autio, E.	A theoretical grounding	2008	SBEJ	3	1												1				1		1		
77	McMullen, J. et al.	Economic Freedom and the	2008	ETand	3	1												1				1				
78	Naude, W. et al.	Regional determinantes of	2008	EandR	2	1			1			1						1				1				
79	Schött, T.; Jensen,	The Coupling between	2008	Estud.	3	1												1				1				
80	Terjesen, S.; Szerb,	Dice thrown from the	2008	Estud.	1						1							1	1							
81	Driga, O. et al.	Reasons for the Relatively	2009	Soc	1			1				1						1	1							
82	Fernández, J. et al.	Cognitive Aspects of Po-	2009	RdEM	1		1									1		1	1							
83	Hechavarria, D.;	Cultural norms and busi-	2009	IEMJ	3		1											1				1				
84	Jones-Evans, D.;	The Spatial Dispersion of	2009	EurPS	2				1			1											1			
85	Koellinger, P.;	Unemployment benefits	2009	Ec.	3	1												1				1				
86	Larroulet, C.;	Entrepreneurship and	2009	Ind.Re	3	1				1															1	
87	Levie, J.; Lerner, M.	Resource Mobilization and	2009	FBR	1				1									1	1							
88	Reynolds, P.D.	Screening item effects in	2009	SBEJ	3												1	1					1			
89	Romaní, G. et al.	Financing entrepreneurial	2009	VC	3	1			1														1			
90	Roper, S.; Scott,	Perceived Financial Barri-	2009	ISBJ	1			1	1									1	1		1					
91	Samujh, R.H.	New Zealand entrepre-	2009	WRE	3		1																1			
92	Stephen, F. et al.	The responsiveness of	2009	SBEJ	3	1												1				1				
93	Terjesen, S.; Hes-	Varieties of export-oriented	2009	Asia	3	1	1						1					1				1				
94	Thompson, P. et al.	Women and Home-based	2009	ISBJ	1			1										1	1							
95	Valliere, D.;	Entrepreneurship and	2009	EandR	3					1								1							1	
96	Autio, E.; Acs, Z.	Intellectual Property Pro-	2010	SEJ	1	1					1							1	1							
97	Burke, A. et al.	How does entrepreneurial	2010	VC	1				1									1	1							
98	De Clercq, D. et al.	The moderating effect of	2010	Int.Bus	1	1	1						1					1	1			1				
99	Elam, A.; Terjesen,	Gendered Institutions and	2010	EJDR	1	1	1	1										1	1							
100	Galindo Martin, M.	Entrepreneurship, income	2010	IEMJ	3					1								1							1	

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101	Klvver, K.; Hindle	The Role of 'Professional	2010	J Ent	1								1					1	1						
102	Kobeissi, N.	Gender factors and female	2010	J Int	3			1										1				1			
103	Kwon, S.W.; Are-	Nations of entrepreneurs:	2010	JBV	1	1		1					1			1		1	1		1				
104	Minniti, M.	Female Entrepreneurship	2010	EJDR	1			1										1	1						
105	Pfeifer, S.; Sarlija,	The Relationship between	2010	J Ent	2					1	1											1			1
106	Stephan, U.; Uh-	Performance-based vs	2010	JIBS	3	1											1	1			1				
107	Terjesen, S.;	Female Entrepreneurship in	2010	EJDR	3	1		1										1				1			
108	Thompson, P. et al.	Education and entrepre-	2010	ISBJ	1													1	1						
109	Wennekers, S. et al.	The Relationship between	2010	FTEnt	3					1								1				1			

Journal abbreviations: Asia Pac J: Asia Pac J Management; BSR: Business Strategy Review; CLLandPJ: Comparative Labor Law and Policy Journal; EandRD: Entrepreneurship and Regional Development; Ec. Let.: Economics Letters; EJDR: European Journal of Development Research; Estud. d Ec.: Estudios de Economía; ETandP: Entrepreneurship: Theory and Practice; EurPS: European Planning Studies; FBR : Family Business Review; FTEnt: Foundations and Trends in Entrepreneurship; GBER: Global Business and Economics Review; landHE: Industry and Higher Education; IAER: International Advances in Economic Research; IEMJ: International Entrepreneurship and Management Journal; IJEBr: International Journal of Entrepreneurial Behaviour and Research; IJESB: International Journal of Entrepreneurship and Small Business; IJGSB: International Journal of Globalisation and Small Business; Ind.Rev.: The Independent Review; Innovations : Innovations; Int.Bus.R.: International Business Review; Ir. J. Manag.: Irish Journal of Management; ISBJ: International Small Business Journal; J Ec. Psych.: Journal of Economic Psychology; J Ent: Journal of Entrepreneurship; J Ent. Cult.: Journal of Enterprising Culture; J Evol. Ec. : Journal of Evolutionary Economics; J Int Ent: Journal of International Entrepreneurship; JBV : Journal of Business Venturing; JIBS: Journal of International Business Studies; JSBE: Journal of Small Business and Entrepreneurship; JSBED: Journal of Small Business and Enterprise Development; Managem.: Management (Split); Publ. Ch.: Public Choice; RdEM: Revista de Economía Mundial; Reg. Stud.: Regional Studies; SBEJ: Small Business Economics; SEJ : Strategic Entrepreneurship Journal; SER : Small Enterprise Research – The Journal of SEANZ; Soc Rur : Sociologia Ruralis; TESSG: Tijdschrift voor economische en sociale geografie; VC: Venture Capital; WIMR: Women in Management Review; WREMSD: World Review of Entrepreneurship, Management and Sust. Development.

**Table 2: GEM APS-based publications by years and SSCI-listing**

	2003	2004	2005	2006	2007	2008	2009	2010	Total
non SSCI-listed journal	1	9	3	5	12	7	4	10	51
SSCI-listed journal	0	1	8	6	13	15	11	4	58
<b>Total</b>	<b>1</b>	<b>10</b>	<b>11</b>	<b>11</b>	<b>25</b>	<b>22</b>	<b>15</b>	<b>14</b>	<b>109</b>



**Table 3: Topics and explained dependent variables**

		Micro level			Macro level			
The numbers indicate how many papers analyse the respective topics and the respective dependent variables. Please note that one paper can be attributed to multiple topics and multiple dependent variables. Thus, the total number in the table exceeds the total number of articles.	Total number of articles	Entrepreneurial activity	Entrepreneurial intentions	Entrepreneurial perceptions	Entrepreneurial activity	Entrepreneurial intentions	Entrepreneurial perceptions	GDP
<b>Formal institutions</b> (e.g., institutional theory, framework conditions, policy, taxes, soc. security)	<b>34</b>	6	1	0	<b>23</b>	0	2	2
<b>Informal institutions</b> (e.g., cultural aspects, normative influences, migration status, ethnicity)	<b>24</b>	7	3	1	<b>11</b>	1	1	0
<b>Women entrepreneurship</b> (e.g., female entrepreneurship, gender differences, gender gap)	<b>20</b>	<b>11</b>	0	2	<b>7</b>	0	0	0
<b>Attitudes and perceptions</b> (e.g., recognition of opportunities, knowledge, fear of failure)	<b>17</b>	7	2	3	3	1	0	0
<b>Regions</b> (e.g., regional start-up rate, regional clusters)	<b>17</b>	<b>5</b>	3	0	<b>7</b>	0	1	1
<b>Financial aspects</b> (e.g., availability of start-up finance, business angel activities, FDI)	<b>16</b>	<b>9</b>	0	2	<b>5</b>	0	0	0
<b>Networks</b> (e.g., network embeddedness, communication networks, role models)	<b>15</b>	<b>6</b>	1	5	2	1	0	0
<b>Economic growth</b> (economic growth on a regional or national level)	<b>15</b>	0	0	0	6	0	1	8
<b>Business growth</b> (growth on a firm level, growth intentions, business development)	<b>10</b>	3	0	0	6	0	0	1
<b>Internationalization</b> (e.g., firms' decisions to internationalize, export-orientation)	<b>4</b>	1	0	1	2	0	0	0
<b>Innovation</b> (e.g., technological change, degree of innovativeness on an individual level)	<b>3</b>	1	0	0	1	0	0	1
<b>Total</b>		<b>56</b>	<b>10</b>	<b>14</b>	<b>73</b>	<b>3</b>	<b>5</b>	<b>13</b>

**Table 4: Employed methods and dependent variables**

Numbers of papers using the respective statistical method and the respective dependent variable. Please note that one paper could be attributed to multiple topics and multiple dependent variables.	Micro level			Macro level				Total
	Entrepreneurial activity	Entrepreneurial intentions	Entrepreneurial perceptions	Entrepreneurial activity	Entrepreneurial intentions	Entrepreneurial perceptions	GDP	
Descriptives	35	5	6	41	1	3	5	<b>96</b>
Regression analysis	8	2	2	32	2	2	7	<b>55</b>
Correlation analysis	14	1	3	27	1	2	2	<b>50</b>
Logistical regression / Logit probit	28	5	4	4	1	0	0	<b>42</b>
Comparison of means	9	1	2	7	0	3	1	<b>23</b>
Anova / Ancova / Manova / Mancova	2	1	3	2	0	0	1	<b>9</b>
Factor analysis	2	0	0	0	0	0	1	<b>3</b>
Cluster analysis	2	0	0	1	0	0	0	<b>3</b>
Non parametric stats	3	0	0	0	0	0	0	<b>3</b>
SEM	1	0	0	0	0	0	0	<b>1</b>
<b>Total</b>	<b>104</b>	<b>15</b>	<b>20</b>	<b>114</b>	<b>5</b>	<b>10</b>	<b>17</b>	

**Table 5: Summary of recommendations**

	<b>Users of existing GEM data</b>	<b>National GEM teams and GEM coordination team</b>
Data sources	<ul style="list-style-type: none"><li>– Combine GEM data with macro level data from other sources.</li></ul>	<ul style="list-style-type: none"><li>– Consider including additional questions in the questionnaire to obtain data on topics not covered in the standard GEM questionnaire.</li><li>– Include well-grounded special topic questions.</li></ul>
Variables used	<ul style="list-style-type: none"><li>– Use a measure of entrepreneurial activity that fits your research question; consider calculating your own measure based on GEM micro data when existing measures do not fit.</li><li>– Allow for time lags when analysing the impact of entrepreneurial activity on national and regional economic growth.</li><li>– Avoid using perceptual variables as determinants of entrepreneurial activity on the micro level; consider regional or national perceptions rates to avoid causality problems.</li></ul>	<ul style="list-style-type: none"><li>– Investigate the (possibly reciprocal) relationship between perceptual and activity variables; look at the determinants of entrepreneurial perceptions.</li><li>– Try to develop questions that allow a better understanding what nascent entrepreneurs are doing.</li><li>– Provide a code book to increase the transparency of the data set.</li></ul>
Level of analysis	<ul style="list-style-type: none"><li>– Conduct multilevel analyses where the dependent variable is micro level and the independent variables are from the micro and the macro level.</li><li>– Consider working on the regional or industry level.</li></ul>	
Hypotheses driven research	<ul style="list-style-type: none"><li>– Develop rigorous testable hypotheses from theory.</li><li>– Evaluate the economic significance of an effect and report the overall explanatory power of the model.</li></ul>	
Measurement schemes	<ul style="list-style-type: none"><li>– Treat validity and reliability issues seriously.</li></ul>	<ul style="list-style-type: none"><li>– Do direct comparisons of GEM single item measures and corresponding multiple item measures to assess their psychometric characteristics; exchange items if required.</li></ul>
Statistical procedures	<ul style="list-style-type: none"><li>– Take into account that on the micro-level entrepreneurial activity might have to be treated as a rare event.</li></ul>	