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High-growth firms: introduction to the special section

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High-growth firms (HGFs) have attracted considerable attention recently, as academics and policymakers have increasingly recognized the highly skewed nature of many metrics of firm performance. A small number of HGFs drives a disproportionately large amount of job creation, while the average firm has a limited impact on the economy. This article explores the reasons for this increased interest, summarizes the existing literature, and highlights the methodological considerations that constrain and bias research. This special section draws attention to the importance of HGFs for future industrial performance, explores their unusual growth trajectories and strategies, and highlights the lack of persistence of high growth. Consequently, while HGFs are important for understanding the economy and developing public policy, they are unlikely to be useful vehicles for public policy given the difficulties involved in predicting which firms will grow, the lack of persistence in high growth levels, and the complex and often indirect relationship between firm capability, high growth, and macro-economic performance.

JEL classification: L25, L26.

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1. Introduction

On safari, tourists' cameras are focused on gazelles, waiting for a sudden spurt of photogenic action. But the ecologist's eye is drawn to the beauty of the humble dung beetle and how its machinations help maintain the health of a complex ecosystem. Why then would economists want to focus on economic gazelles, the small percentage of high-growth firms (HGFs) in the economy, given the complexity of modern industrial ecosystems? On the African savanna the health of gazelles provides a clear indication of the health of their local ecosystem, but in the economy the relationship between HGFs and a high-growth economy is much less direct and clear. As Rosenberg and Steinmueller (2013) have recently argued in this journal, much productivity-enhancing technical change is incremental, distributed, and grubby, more like the overlooked work of thousands of dung beetles than the spring of a few gazelles. Why then would economists be interested in HGFs?

Interest in HGFs can be explained in one word: jobs. As Nightingale and Coad (2014) highlight in this issue, the period of unemployment growth that followed the oil shocks increased interest in small firms. In a seminal work, Birch (1979) presented paradigm-changing evidence that small firms in the United States were more important job creators than large firms. This was the case even though large companies accounted for the largest employment share at any given point of time. Large American firms had larger shares of job destruction, creating a dynamic process where large companies declined to be replaced by firms that had previously been small. At the time the evidence seemed clear: small firms create jobs, while large firms lose them.

Birch's findings were highly controversial. Brown *et al.* (1990), Davis *et al.* (1996), and others questioned them on methodological grounds. Davis *et al.* (1996), for example, did not find any clear relationship between firm size and job creation for the time period 1973–1988 in the United States after correcting for the regression to the mean. Neumark *et al.* (2011) observe a nonmonotonic relationship between job creation and firm size, such that small new entrants create jobs but that “if we exclude births, the net job creation rate is slowest at the smallest firms” (p. 23). Haltiwanger *et al.* (2013) similarly show that it is young firms, rather than small firms, that are responsible for job creation: “our main finding is that once we control for firm age there is no systematic relationship between firm size and growth” (p. 347).

However, evidence also showed that although most small firms do not grow (or only grow slowly), a few HGFs are crucial for job creation (Birch and Medoff, 1994; Brüderl and Preisendörfer, 2000; Davidsson and Henrekson, 2002; Delmar *et al.*, 2003; Littunen and Tohmo; 2003; Halabisky *et al.*, 2006; Acs *et al.*, 2008; Acs and Mueller, 2008). One of the most robust results in industrial dynamics is that growth rates are extremely skewed. As a result, as interest in small firms per se has declined, interest in the factors explaining the prevalence of HGFs has increased. When

Henrekson and Johansson (2010) reviewed the literature on HGFs in 2010 they identified only 20 studies published since 1990, which was fewer than expected considering the importance of the topic. However, since 2010 the topic has exploded and a Google Scholar search shows that >100 papers have “high-growth firms” or “gazelles” in their title. Similarly, Henrekson and Johansson’s (2010) literature review now has 251 citations according to scholar.google.com (retrieved 7 November 2013), highlighting the increasing amount of attention that HGFs have recently received.

This increased academic interest has policy implications. An increasing number of academic studies question the wisdom of supporting new start-ups, and instead suggest policies should focus on the small number of high-potential firms in the economy. Shane (2009), for example, questions supporting more start-ups since most have limited growth ambitions, capabilities, or chances of survival. Hölzl (2010) distinguishes between Small and Medium Enterprises (SMEs) policy, which seeks to support all SMEs, and entrepreneurship policy, which seeks to support only firms with growth ambitions. Policymakers have picked up these ideas and the European Commission lists support for high-growth SMEs as a political objective in its *Europe 2020 Strategy* report (European Commission, 2010). The Organization for Economic Cooperation and Development (OECD) similarly asks how governments promote high-growth enterprises (OECD, 2010).

This increased academic and policy interest can draw on a number of seminal studies. Research has investigated whether HGFs are small (Delmar, 1997; Delmar and Davidsson, 1998; Weinzimmer *et al.*, 1998; Delmar *et al.*, 2003; Shepherd and Wiklund, 2009); young (Delmar *et al.*, 2003; Haltiwanger *et al.*, 2013); belong to an enterprise group (Delmar *et al.*, 2003); are family-owned (Bjuggren *et al.*, 2013); belong to a certain industry (Delmar *et al.*, 2003; Davidsson and Delmar, 2003, 2006; Halabisky *et al.*, 2006; Acs *et al.*, 2008); region (Stam, 2005; Acs and Mueller, 2008); or country (Schreyer, 2000; Bravo-Biosca, 2010), and so on. Most of these early studies implicitly assume that investigating HGFs can lead to policies that increase their number in the economy.

Given this increased interest, the Ratio Institute in Stockholm hosted a workshop on HGFs in May 2011 to bring together new research on HGFs. Eighteen researchers from 7 countries attended the workshop, and 12 papers were presented and discussed. After a review process, seven papers were finally selected for this special section on HGFs. The rest of this introduction contextualizes the papers, highlights the problems involved in research in this area, and explores the papers’ findings and their implications for our understanding of HGFs.

2. Identifying and researching HGFs

When researching HGFs, it is obviously important to know what one is talking about and understand how such firms can be identified. Unfortunately, there is a lack of

consensus on this key question in the literature. Economic and management theory does not yet provide much guidance on how to measure the share of HGFs in either an industry or the economy.

In an important contribution, Delmar and Davidsson (1998) emphasize that at least four issues need to be taken into account when measuring firm growth: (i) the indicator of growth; (ii) measurement of growth (relative vs. absolute change); (iii) the period studied; and (iv) the process of growth. It is instructive to discuss these four issues in some detail.

The indicator of growth refers to the variable over which growth is observed. The most commonly used indicators in the high-growth literature are sales and number of employees (Daunfeldt *et al.*, 2013a). All papers in this special section use at least one of these. Although sales and employment growth are only modestly correlated (Shepherd and Wiklund, 2009; Coad, 2010), most studies suggest that the results do not seem to be sensitive to which one is chosen (Daunfeldt *et al.*, 2013a).

On the other hand, whether growth is measured in relative or absolute terms does make a difference. Almus (2002) and Daunfeldt *et al.* (2013a) show that the selection of HGFs using different growth measures is primarily driven by whether high growth is measured as absolute or relative growth. HGFs defined by relative growth tend to be smaller than those that are fast growing in absolute terms. This suggests that measures of absolute (relative) growth are biased toward larger (smaller firms). The issue whether absolute changes or relative changes should be preferred is difficult to resolve and depends also on the research question being addressed.

It is important to note that relative growth can be measured in many different ways—percentage change, taking log-differences, scaling down by initial size, or scaling down by average size. Tornqvist *et al.* (1985) provide a useful survey of different ways of measuring relative growth. Importantly all measures of relative growth are monotonic transformations that do not affect the ranking of firms. Tornqvist *et al.* (1985) prefer the log percent change as a measure of relative growth because it is symmetric.

Absolute change, on the other hand, refers to raw changes in size between two time points, and is sometimes used in the literature. More popular are indices that combine absolute and relative change into one number. The most widely used measure is the Birch index, which is a combined way of capturing absolute and relative numbers of employees (Schreyer, 2000, more on this in Hölzl, 2014, this issue). The index is used because it reduces the impact for firm size on the growth indicator, with the expectation that this indicator will be less biased toward identifying small firms as HGFs. The Birch index is defined as follows:

$$(E_t - E_{t-k}) \left(\frac{E_t}{E_{t-k}} \right), \quad (1)$$

where E_t is the number of employees in year t . By weighting the absolute growth with relative growth, the index is supposed to smooth out the probability of classifying large and small businesses as HGFs. However, Hölzl (2014) shows that the Birch index for larger firms is primarily driven by absolute employment changes and hence it does not provide a ready solution to the question of whether relative or absolute growth should be used.

To correct for one-off expansions, and to reduce the amount of statistical noise by smoothing over years, most studies calculate growth rates over a time horizon of a few years. Three- or four-year periods are used in most previous HGF studies, although some studies have used shorter as well as longer periods (Henrekson and Johansson, 2010). However, Hölzl (2014) and Daunfeldt and Halvarsson (2012) show that this smoothing strategy does not eliminate the problem that most HGFs (especially when relative growth rates are used) experience their high growth event in one year. This is an important and as yet unresolved issue.

Another key issue relates to researchers' ability to distinguish between organic (internal) and acquired (external) growth, where organic growth refers to new employment that is internal to a firm, while acquired refers to gains in employment that occur through external acquisitions or mergers. With few exceptions, most studies use total growth (i.e. the sum of organic and acquired growth) because of lack of data on mergers and acquisitions. McKelvie and Wiklund (2010) argue that research into firm growth should focus on differences between growth modes (i.e. shift emphasis from "how much" to "how" firms grow), although Spearot (2012) suggests that this is not especially problematic since internal and external growth is guided by similar decisions within firms.

2.1 Defining HGFs

Given these choices about how to identify HGFs, they are usually defined in one of two ways. The first method is to define HGFs as the share of firms in a population that see the highest growth during a particular period, for instance, the 1% or 5% of firms with the highest growth rate. One disadvantage of this methodology is that it hinders researchers' ability to compare the share of HGFs across time or across countries. To overcome this, a second approach is used, which defines HGFs as firms growing at or above a particular pace, measured either in terms of growth between a start and end year, or as annualized growth over a specific number of years. For example, Eurostat and the OECD recommended that HGFs should be defined as firms with at least 10 employees in the start-year and annualized employment growth exceeding 20% during a 3-year period (Eurostat-OECD, 2007). Hölzl (2014) used this approach to define HGFs in this special section, while Autio *et al.* (2000) and Halabisky *et al.* (2006) define HGFs as firms that obtained at least 50% sales growth during each of three consecutive financial years.

2.2 Research biases and methodological problems

Once HGFs are defined, researchers face formidable statistical and conceptual problems in researching HGFs and small firms more generally. In this special section, Nightingale and Coad (2014) explore these in detail and highlight that they have historically led to a considerable positive bias in interpretations about the economic impact of entrepreneurial start-ups on the economy. They hint at two biases: first, an increasingly positive interpretation as one moves from research to policy, and second, an increasingly positive interpretation as one goes back in time, suggesting better data and methods are leading to more negative interpretations. They highlight considerable demand side biases for positive results from politicians and lobbies, and also important supply side problems that constrain research.

In particular, they highlight problems with (i) data quality related to the lower reporting requirements small firms have, leading to less comprehensive and detailed data, leading to a trade off and uncertainty principle between data quality and coverage. This leads to problems with (ii) unrepresentative samples, which often focus on the tiny minority of successful cases. This problem is made worse by (iii) the extremely skewed statistics. The skewed distributions found in analysis can make conventional regression strategies (such as Ordinary Least Squares regression (OLS)) that focus on “the average effect for the average firm” very misleading, and make it difficult to conceptualize the typical firm. This has led to problems with (iv) flexible definitions, which has led to a variety of definitions and considerable confusion between entrepreneurial, small, and new firms. As they highlight, most new firms are small, but most small firms are old. There are also statistical problems with (v) regression to the mean that typically biases results in favor of smaller firms. These problems make it difficult to produce robust results and have led to (vi) conceptual slippage in the literature, with conflation between entrepreneurship as a process of starting and firm, and as a process of coordinating the economy, which are two different activities.

Denrell and Liu (2012) make an important but still underappreciated point that noise and self-reinforcing dynamics in the economy (such as the Matthew effect) make performance unpredictable, and lead to a relatively weak association between ability and performance. As a result, high-performance firms, by any metric, may reflect structural features of the economy rather than exceptional ability. Particularly when survivor bias is a problem, high performance can be the result of high risk–high reward behavior that on average has a lower performance than alternatives. When this is the case, it would be misleading to imply that the highest *ex post* performance firms have the highest expected ability and hence their behavior should not be encouraged by policymakers or copied by firms. Interview-based research on people who play Russian Roulette for money, that finds it is a safe and profitable activity, clearly suffers from survivor bias (Nightingale, 1997), yet policymakers and researchers still remain uncritically impressed by successful firms and entrepreneurs (Nightingale and Coad, 2014).

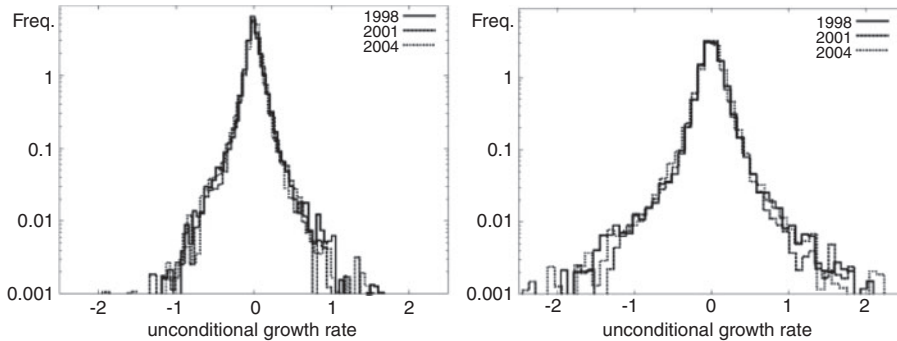


Figure 1 Distribution of the unconditional growth rates of employment (left) and sales (right) for a sample of French manufacturing firms (Coad, 2010). Note the log scale on the y-axis.

3. Seven stylized facts about HGFs

These problems have led to research findings that are often highly fragmented. However, researchers are increasingly addressing them in a robust way and generating robust findings. Seven of these findings are robust enough to amount to stylized facts about HGFs. These are given in the following sections.

3.1 SF 1: growth rates distributions are heavy-tailed

Firm growth rates (log differences) have been shown to resemble a Laplace distribution (see Figure 1) with its characteristic “tent-shape” (Stanley *et al.*, 1996; Bottazzi and Secchi, 2006), with most firms not growing at all, and only a few with high growth.¹ This suggests that the more interesting phenomena of firm growth take place in the tails of the distribution and that researcher should look at firms with extreme growth events and at the dynamics of firm growth rates. For this reason the focus of researcher has been directed toward the right-tail of the firm growth rate distribution, i.e. firms showing high growth rates. However, high decline firms have not yet received the attention they merit.

3.2 SF 2: a small number of HGFs create a large share of new jobs

Following on from SF1, the fact that the growth rate distribution closely resembles the Laplace distribution implies that a small number of HGFs creates most new jobs

¹This result may seem to be restrictive because it holds in strict sense only for growth measured as log differences; however, it is general as every measure of relative growth is only a monotonic transformation of any other measure. Thus the basic insights hold for all different measures of relative growth when the appropriate monotonic transformation is taken into account.

at a specific point in time. This has also been confirmed in a large number of empirical studies that more closely have investigated the job contribution of HGFs. Storey (1994), for example, found that 4% of firms create 50% of the jobs. In an influential report, *The Vital 6 Per Cent*, Nesta (2009) argued that 6% of all firms generated 49.5% of all new jobs created by existing firms in UK during 2002–2008. Similar figures have been reported for other countries. Daunfeldt *et al.* (2013b) showed that the 6% fastest growing firms in the Swedish economy contributed to 42% of the jobs in Sweden during 2005–2008. These numbers show that job creation is very much concentrated in a few firms.

3.3 SF 3: HGFs tend to be young but are not necessarily small

A number of studies has investigated the characteristics of HGFs. The results indicate that small firms are overrepresented among HGFs when growth is measured in relative terms, but, large firms are more likely to be HGFs when growth is measured in absolute terms (Delmar *et al.*, 2003). Most studies seem to come to the result that most HGFs are small but that there is also an important subset of large HGFs (cf. Acs *et al.*, 2008). The finding that HGFs tend to be younger than the average firm in the industry is much more robust, and seems independent of the choice of growth measurement (Daunfeldt *et al.*, 2013a).

3.4 SF 4: HGFs are not more common in high-tech industries

Some authors link high growth with superior innovative potential. While this might be true in an entrepreneurial sense it seems to not be the case in a technological sense. Thus, the typical HGF is not a high-technology firm. Being a HGF is primarily an economic and not a strictly technological phenomenon (Hözl, 2009). Many policies for promoting HGFs are directed toward high-technology industries. OECD (2010), for example, reports that most of the actual policy initiatives implemented across its member countries rely on the facilitation of access to finance and the support to R&D and innovation. Mason and Brown (2013: 214) note that “this clearly indicates that policy-makers view high-technology sectors as the main generators of potential HGFs,” even though the literature survey by Henrekson and Johansson (2010) clearly indicates that there is no evidence to support the view that HGFs are overrepresented in high-technology industries. If anything, there appear to be more HGFs in service industries relative to other sectors such as manufacturing.

3.5 SF 5: high growth is not to be persistent over time

Most studies have investigated HGFs using static analysis. However, policy implications from these studies are of little relevance if firm growth is random, i.e., if HGFs in period t in general are not HGFs in period $t + 1$. Recent studies tend to

indicate that high growth events are not persistent over time. Coad (2007) and Coad and Hözl (2009) used quantile regression techniques to analyze whether persistence was affected by firm size and firm growth. They found negative autocorrelation in the annual growth of small fast-growing firms, making sustained growth unlikely. Larger firms, on the other hand, showed positive autocorrelation or none. Parker *et al.* (2010) observe that HGFs do not display persistence in their growth performance once the high-growth event is finished. Daunfeldt and Halvarsson (2012) found that the probability that a HGF in one period remained a HGF in the 3-year period was 0.01, which is the same probability that some arbitrary firm would remain in that growth category. Hözl (2014) confirms these results in this special section, but also finds that the persistence of high growth seems to depend on the choice of growth measurement. This is an extremely important and underappreciated finding that questions the value of HGFs as vehicles for public policy.

3.6 *SF 6: difficult to predict which firms are going to grow*

Some policy observers are calling for policies to support high growth. The European Commission (2010), for example, mentions support of high-growth SMEs as a political objective in its Europe 2020 strategy, proposing the share of fast-growing innovative firms as a top indicator to measure the strategy's progress. However, SF 5 (lack of persistence) strongly suggests that it is difficult to target HGFs before their high growth event. This puts limits on the policy instruments that can be used to support HGFs. Policy schemes that target specific firms are not likely to target potential HGFs that would be unsuccessful without support. Windfall gains and the targeting of entrepreneurial ventures with low growth potential are a likely outcome. This suggests that the policy focus should be on the identification of barriers to firm growth dynamics. One troublesome fact, however, is that it seems hard to predict which firms are going to be HGFs *ex ante* (Storey, 1994; Hözl, 2009).

Some factors, such as size, age, legal form, etc, consistently have an influence on growth rate. Nevertheless, the R²-values of models that are estimated to explain high-growth events are low, usually explaining <10% of the variation in the data (see e.g. Coad, 2009, Table 7.1). Therefore, not much is known about the determinants of HGFs. This has led researchers to conclude that “growth is mainly affected by purely stochastic shocks” (Marsili, 2001: 18).

3.7 *SF 7: the use of different growth indicators selects a different set of firms*

The choice of growth indicator influences the results. Shepherd and Wiklund (2009) found that employment and sales growth were only modestly correlated. Delmar *et al.* (2003) has also emphasized that they represent two different growth phenomena, with employment growth indicating resource growth and sales growth representing product/service acceptance in the market. Daunfeldt *et al.* (2013a)

also showed that there exists a clear trade-off between HGFs defined in terms of employment growth and productivity growth, while the results were not sensitive to whether employment or sales was used as growth indicator.

4. Remaining controversies

There are a number of important controversial issues in this relatively new field of research. The most important controversies concern (i) the methodology of selecting HGFs; (ii) the aggregate implications of having a larger share of HGFs; and (iii) the policy implications of available research results. To properly understand research on HGFs it is useful to discuss these controversies in detail.

As noted earlier, there is still no consensus on how HGFs should be defined, which is problematic because methodological choices influence the policy implications that can be drawn from research on HGFs. Unfortunately, the theoretical literature in economics, management, and entrepreneurship does not yet provide much guidance on this important question, with the results that open methodological questions lead to controversies.

It has become increasingly popular to use the Eurostat-OECD definition when identifying HGFs (Bravo-Biosca, 2010; Nordic Council of Ministers 2010; Hölzl, 2014), reflecting Eurostat and OECD's role in the provision and analysis of official statistics (European statistical offices use this definition to compile official statistics on HGFs). The definition has the advantage that it allows comparisons over time and across countries, without the need to access micro data. It is also time-independent, in contrast to most definitions that define HGFs as the 1% or 5% of firms with highest growth rates. However, Daunfeldt *et al.* (2013b) show that the Eurostat-OECD definition excludes a large number of firms and their job creation because it restricts attention to firms with at least 10 employees. This raises a question about what kind of economic activity should be measured by *any* definition of HGFs. Should all firms with high-growth rates be counted as HGFs, or only firms with large absolute changes (in terms of employment, sales, or productivity)? While it seems to be clear that a measure of HGFs should not be a replacement for the prevalence of small firms in an economy, this particular example shows that the question whether to use relative or absolute growth is still open.

Closely related is the issue whether firm growth should be measured in employment growth. The almost exclusive focus on employment growth in many newer studies on HGFs is controversial. From a public policy perspective, targeting employment generators could be suboptimal if it creates incentives that disfavors HGFs in terms of productivity (cf. Aiginger, 2006, 2007). According to Bravo-Biosca (2010: 16), policymakers should not only focus on employment-HGFs since "they are not on their own sufficient to address the wider failure to thrive and failure to shrink that hampers Europe's productivity performance." However, policymakers sometimes

emphasize the importance of focusing on employment growth. This shows that there are important controversies with regard to the aggregate implications of having more HGFs.

One argument is that it is the economic problem *per se* that should guide us. Rapid growth in absolute employment could then be the choice if the goal is to quickly reduce unemployment, while relative growth in productivity could be used if economic policy targets long-run economic growth. Only a few studies compare HGFs across countries, and the findings seem to suggest that a higher share of HGFs is associated with a higher share of firms that display large job losses (Hölzl, 2011). At the same time the findings suggest that higher productivity growth is associated with a more dynamic growth distribution (more high growth and high decline firms). However, we do not know much about the direction of causality of these processes at the industry and the aggregate level. Thus, even the widely held policy conclusion that countries should aim at having more HGFs is controversial. By contrast, the claim that countries should reduce general barriers to competition, for example, is much less controversial, and reflects how these policy implications are derived from a different literature and can be traced back to clear theoretical concepts and findings.

This leads to a controversy about the policies for HGFs. Should policies target specific firms, or the broader business environment? A number of studies have, for example, analyzed what characterizes HGFs and whether the share of HGFs differs across countries (Schreyer, 2000; Bravo-Biosca, 2010). The idea is that we might learn something from these studies that later can be used to formulate policies. However, such studies may be of little relevance for policy if firm growth is random, i.e., if HGFs in period t in general are not HGFs in coming periods. The relevance of studying HGFs at a specific point in time thus depends on whether high-growth rates tend to persist. If high-growth events do not persist, this challenges the notion that policymakers can target HGFs to promote future firm growth. The available evidence is not encouraging in this respect (Birch, 2006; Daunfeldt and Halvarsson, 2012; Hölzl, 2014).

However, if one relates business dynamism to institutional elements of the business environment, more encouraging answers are available. In a recent OECD working paper, Bravo-Biosca *et al.* (2013) found that financial development, banking competition, and institutions that foster better contract enforcement are associated with a more dynamic growth distribution and a higher share of fast growing and fast shrinking firms. More stringent employment/labor laws and generous R&D support seems to be associated with a lower number of HGFs. However, this is one study and not much is yet known about the aggregate implications of having a higher share of HGFs and a more dynamic growth rate distribution.

Some researchers (Derbyshire, 2012) have also warned that the recent focus toward HGFs might become a new policy obsession, maybe similar to the ongoing focus toward small firms (Nightingale and Coad, 2014). Storey (2006) demonstrates that close to 8 billion pounds are spent each year by the UK government on

supporting small firms, despite the fact that there is not much evidence that this is beneficial for the economy. There is also a concern that a more extensive targeting of firms may result in more unproductive entrepreneurship (Baumol, 1990; Shane, 2009) since the return to such activities then will increase.

Policies toward potential HGFs may also target the wrong enterprises. Here it is important to note that both subsidies and regulations provide explicit or implicit incentives for entrepreneurs and firm managers, that may affect their behavior to provide goods and services that are demanded by consumers. Here it is also important to note that much of the dynamics of small firms can sometimes be subsumed to a process of “turbulence” that refers to the fact that there is a large number of firms of suboptimal size that enter and exit the markets (Geroski, 1995). In this context, Santarelli and Vivarelli (2007) call for a distinction between “turbulence” and true “entrepreneurship” and remind us that Schumpeter (1926) already observed that the majority of small entrepreneurial ventures is due to a large majority of “imitators” and a tiny minority of “innovators.”

5. The special section

This special section consists of seven self-contained papers on HGFs that reflect a broad spectrum of current research on HGFs. Table 1 provides an overview.

The first paper *Muppets and Gazelles: Political and Methodological Biases in Entrepreneurship Research* by Nightingale and Coad (2014) documents the patterns of increasingly positive interpretation of the benefits of entrepreneurship as one moves from analysis to policy. The authors present a critical evaluation of the role of entrepreneurship for economic growth, arguing that the majority of start-ups are not potential HGFs but “marginal undersized poor-performance enterprises” with limited growth ambitions and a lack of capability (see also Santarelli and Vivarelli, 2002; Vivarelli, 2013).

Three papers that are related to the industry structure of HGFs then follow.

Bos and Stam (2014) investigate how the presence of gazelles, young high-impact firms, is related to the growth of industries over time using a panel vector autoregressive model. Their results indicate that more gazelles in an industry have a positive effect on subsequent industry growth, while there is no evidence of an inverse causal relationship. However, no evidence is found that overrepresentation of gazelles is a predictor of subsequent industry growth. In their conclusion, the authors emphasize that “removing the barriers to growth of new firms in industries of their own choice, i.e. horizontal industrial policy, is a no-regret policy that is likely to enhance job creation in general.”

Huber *et al.* (2014) construct an econometric model that simultaneously takes into account initial firm size, firm survival, and firm growth to estimate firm-specific transition probabilities between size classes. They use this model to study the impact

Table 1 Overview of the papers in the special section

Authors	Data	HGF definition	Research question	Findings
Critical survey Nightingale and Coad	Review existing studies	Multiple	Identifying political and methodological biases in entrepreneurship research	The impact of SMEs on job creation, innovation, and economic growth has often been exaggerated
Industry structure Bos and Stam	43,040 Dutch gazelles, 1997–2008	Firms between 5 and 10 years old, with 20+ employees, that have created at least 20 jobs	Does the presence of HGFs in an industry lead to industry growth?	A higher share of gazelles in an industry is associated with higher future industry growth
Huber, Oberhofer, and Pfaffermayr	All Austrian manufacturing firms, 1972–2004	Firms that grow from the initially smallest firm size quartile to the third or fourth firm size quartile	How do counterfactual policy scenarios affect the prevalence of HGFs?	Structural interactions need to be taken into account when designing policies to foster HGFs
Hölzl	93,480 Austrian firms, 1985–2007	OECD-Eurostat definition and modified Birch index	Do HGFs outperform (survival growth) other firms also after their high growth event?	HGFs have modest growth after a high growth event and slightly higher survival rates. The HGF status is not persistent
Strategies of HGFs Mohr, Garnsey and Theyel	2974 Tech firms in Cambridge UK, 1988–2008	OECD-Eurostat definition	Rapid growth may overstretch a firm's resources. Can alliances supply compensating support for rapidly growing firms?	Alliances and international operations are predictors of rapid growth
Colombelli, Krafft and Quattraro	335 European firms with 1+ patents	Annualized growth rate of at least 20%	Do gazelles follow exploration or exploitation strategies?	HGFs focus more on exploration strategies based on familiar technology
Coad, Daunfeldt, Johansson and Wennberg	500,000 Swedish firms 1999–2002	Four definitions: top 1% and top 5% in terms of employment and sales growth	Whom do HGFs hire?	Hire marginalized individuals

of different counterfactual policy experiments on the intra-distribution dynamics of the firm size distribution and on HGFs. They define a HGF to be a firm that grows from the initially smallest firm size quartile to the third or fourth firm-size quartile. The advantage of this approach is that it allows for disentangling potentially countervailing effects of the studied hypothetical policy scenarios. Their findings show that policies that are directed at increasing entry rates are unlikely to increase the share of HGFs, while policies that aim at increasing entry size are likely to increase the share of fast growers. Increased market growth has positive impact on HGFs while a hypothetical decrease in the age of firms would decrease the share of fast-growing firms. The important message from this paper is that policymakers, even if they are interested only in job creation, need to take into account structural interactions when it comes to design policies to foster HGFs.

Hölzl (2014) studies the persistence, survival, and growth of HGFs and asks whether HGFs are one-hit wonders or whether they tend to outperform also in future periods. Using Austrian data during 1985–2006 and applying a matching method to construct a relevant control group of firms similar in terms of size and age, he finds that the answer depends on which definition of HGFs is chosen. When HGFs are identified using the Eurostat-OECD definition, HGFs have a small probability of repeating their fast-growth event. On the other hand, high-growth events are more persistent when the so-called Birch index is applied (which is more sensitive to large-firm growth). But, irrespective of the chosen definition, HGFs have higher growth rates than firms in the control group after the fast-growth period. However, these growth rates are modest and the growth rates in the control group are on average negative. The findings thus provide a serious challenge to the view that dedicated government support programs can be designed to target potential fast-growing firms and increase the number of fast-growing firms. The results also cast some doubts on the usefulness of a simple HGF-indicator to measure sustainable firm growth dynamics across countries.

The last three papers in this special section deal with strategies of HGFs. Mohr *et al.* (2014) investigate in “The Role of Alliances in the Early Development of High-Growth Firms” whether alliance strategies are related to rapid firm growth. Using longitudinal panel data covering 2974 high-tech firms from Cambridge, UK, they find that alliances and international operations are predictors of rapid growth. Interestingly, the provision of venture capital was not positively related to high growth. However, venture capital fostered alliances, which in turn promoted growth. The findings indicate that market- and technology-oriented partnerships among firms may be seen as an alternative to early venture capital investments. They suggest that an issue to be addressed in future research is how to provide new forms of capital from knowledgeable investors on terms that are more desirable to promising young firms.

Colombelli *et al.* (2014) focus on the contribution of HGFs to knowledge creation and innovation, using data on 335 European firms with 1+ patents. Do HGFs follow

explorative or exploitative knowledge creation strategies? Using a vector autoregression approach to investigate the coevolution of sales growth and knowledge creation, the authors find that HGFs engage in exploratory knowledge creation, which might also be referred to as “organized search.”

The remarkable ability of HGFs to create jobs has received a lot of attention, but we know little about what type of jobs they are creating and which types of people come to occupy these jobs. In the final paper of this special section, Coad *et al.* (2014) therefore asked the question “Whom do high-growth firms hire?” Using a matched employer–employee data set on firms in the Swedish knowledge intensive industries during 1999–2002, they find that HGFs are more likely to employ young people, poorly educated workers, immigrants, and individuals who experienced longer unemployment periods. However, these patterns seem contingent on the stage of the firm’s evolution. HGFs that have already realized some rapid growth are more likely to hire individuals from other firms, even though immigrants from Asia, Africa, and Latin America are still overrepresented among new hires. These results are of importance since immigrants from these regions have low employment rates and difficulties to enter the labor market. It thus seems that in addition to creating many new jobs, HGFs are also important because they provide job opportunities for groups that often are marginalized at the labor market.

6. Future challenges

Research on HGFs is a new and vibrant field that contains many interesting results, important policy implications, and controversies. The papers gathered in this special section take this field of research a step further by providing important new evidence on the employment strategies of HGFs, the persistence of high-growth rates, and the importance of young firms for industry performance.

There is clearly still considerable heterogeneity in terms of how HGFs are identified, which HGF definition is applied, the choice of literature, and the economic importance given to HGFs in each of the contributions. This special section consequently provides more of a basis for future research than an overview of preexisting well-established facts. While this introduction has provided an overview of the field, it has also highlighted that much remains to be done.

The first challenge is related to the methodology of defining HGFs, which we emphasized in this Introduction. We are sceptical about the emergence of a single definition of HGFs, as different research questions require different definitions of firm growth and thus different definitions of HGFs. Firm growth is multidimensional, but a cacophony of different definitions of HGFs is not likely to be helpful in establishing a working research field and in aiding the transfer of research results to the policy arena. Theoretical work that builds on established research results from the firm growth literature could be helpful in providing boundaries on possible definitions of HGFs.

One suggestion would be to adopt “multiple partial” indicators, whereby research uses several rather than a single measures, which would allow for easier comparisons across studies, more substantial robustness checks, and qualitative investigation of the differences found between different quantitative indicators.

A second key challenge is to understand why the share of HGFs seems to differ across countries. A few studies have investigated this issue, but the evidence seems to indicate that the share of HGFs differ significantly across countries (Bravo-Biosca, 2010; Bravo-Biosca *et al.*, 2013). For example, Hölzl (2011) showed that fixed country effects explain $\sim 23\%$ of the observed variance of HGF-shares across 11 countries, while fixed sector effects explained $\sim 35\%$ of the overall variation. It is tempting to conclude that this depends on institutional differences (e.g. corruption or red tape) or could be related to economic policy variables (e.g. tax system or insolvency regulation), but the results may also be affected by differences in trade specialization patterns.

Comparative analysis would help understand the kinds of institutional support that are most appropriate for a HGF economy. For example, it is unclear if will we get more (or fewer) HGFs if we have higher entry rates. Questions remain about any potential trade-offs between quantity and quality. Nor do we know what policy instruments effectively foster HGFs and business dynamism. For such international comparative research, data quality remains an issue. Access to representative and comparable data is still difficult, and differences in economic policies may also have an impact on the comparability of statistics across countries if they affect how economic activity is organized.

Thirdly, we do not know much about the internal features of HGFs. High-growth events are periods of intense change. They can be exciting (providing opportunities for promotion, etc) but also periods of stress, flux, and uncertainty. Many key characteristics of HGFs remain unknown. Are they a “superior” species of firm (“better” in every way possible), or are they desperately struggling from day to day to meet orders? Are gazelles like the towering sturdy oaks of Alfred Marshall’s “trees of the forest” analogy,² or are they relatively “flimsy” like fast-growth bamboo? Are they clever innovators, or are they under too much pressure to think straight or take risks? Are they profitable (because of their success) or loss-making (because of the costs of growth)? From a management perspective it would be useful to understand the microeconomic determinants of sustained high growth. We do not know much

²Marshall writes “[W]e may read a lesson from the young trees of the forest as they struggle upwards through the benumbing shade of their older rivals. Many succumb on the way, and a few only survive; those few become stronger with every year, they get a larger share of light and air with every increase of their height, and at last in their turn they tower above their neighbours, and seem as though they would grow on for ever, and for ever become stronger as they grow. But they do not. One tree will last longer in full vigour and attain a greater size than another; but sooner or later age tells on them all. Though the taller ones have a better access to light and air than their rivals, they gradually lose vitality; and one after another they give place to others, which, though of less material strength, have on their side the vigour of youth.” Marshall (1961), 263.

about whether the role of entrepreneur, industry characteristics, organizational innovation during high growth, management styles, firm strategies, and so on, are important for sustaining high-growth over longer periods.

Such research could help address a fourth important topic related to the dynamics of growth rates where there is still a need for more research. Looking at the whole growth distribution is more complex, but likely also more rewarding than concentrating on HGFs alone. For example, research suggests that a larger number of HGFs is associated with a larger number of firms that experience high levels of decline (Bravo-Biosca, 2010, Hölzl, 2011). Thus, increasing the number of HGFs may not necessarily increase employment, but instead increase turnover and economically unproductive churn. Policies fostering HGFs then are implicitly also policies that foster business dynamism (growth and decline of firms). If a higher number of HGFs correspond to a higher share of rapidly declining firms, we might prefer stable jobs and fewer HGFs rather than volatile industries that have many HGFs alongside many fast-decliners. Note also that fast declining firms have received little research in the literature, although there is some evidence available that they in fact are likely to be HGFs in coming periods (Daunfeldt and Halvarsson, 2012). We thus believe that future studies on HGFs should look more carefully also on the left-hand tail of the growth rate distribution.

From an economic policy perspective, even the clear identification of a link between HGFs and economic performance does not provide an automatic justification of policy interventions. Policy interventions typically need to be based on market failure arguments. If no such argument can be identified, public policies fostering entrepreneurship will not contribute to social welfare and can even be counterproductive. However, in modern public economics, market failure is a sufficient but not necessarily mandatory condition for government intervention. The theory of the second best (Lipsey and Lancaster, 1956) argues that it is not true that “a situation in which more, but not all, of the optimum conditions are fulfilled is necessarily, or even likely, to be superior to a situation in which fewer are fulfilled” (p. 12). Only a careful analysis of market and government failures is able to provide a better understanding of what does and does not work *ex ante*. Unfortunately, this has not yet been done, with the result that most policy advice is derived from interpretation of rather general and potentially misleading empirical results.

Economic gazelles, as HGFs are often known, and not just like the gazelles on the African safari highlighted at the start of this Introduction because they suddenly move fast. They are also similar because increased research on them has revealed new and important insights, but in addition highlighted their roles within a wider (economic) ecosystem of considerable complexity and dynamics. Moving from only looking at gazelles to seeing them as part of this richer environment, dung beetles and all, provides a richer and deeper perspective. While it raises new research challenges, which this Introduction has highlighted are considerable, the depths of the new insights it generates are considerable, which suggests a vibrant future for this

research field, which is at the heart of academic research on industrial and corporate change.

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