

BUREAUCRATS

— OR —

MARKETS

— IN —

**INNOVATION
POLICY?**

**CHRISTIAN SANDSTRÖM
KARL WENNBERG
NILS KARLSON**

With a Foreword by Jason Potts

RATIO

CHRISTIAN SANDSTRÖM KARL WENNBERG NILS KARLSON

Bureaucrats or Markets in
Innovation Policy?

Ratio

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Endorsements

Everyone wants more and better innovations, but how? Policy-makers have long searched for magic bullets – state-funded incubators and science parks, targeted subsidies and prizes, entrepreneurship training, improved patent systems, and the like – but none seems to work. As this book demonstrates, the best policies to promote innovation are those that promote economic activity more generally: private property, free and open markets, sound money, and a legal system that favors competition, not particular competitors.

PETER G. KLEIN

Caruth Professor of Entrepreneurship,
Baylor University & Norwegian School of Economics

Governments today are well aware of the importance of entrepreneurship, and they covet the growth and jobs that innovation provides. Academics are often all too willing to oblige with activist “innovation policies” like government subsidies or tariffs directed to favored sectors. As this excellent Ratio Institute study reaffirms, however, the most effective policies a government can use to spur innovation are actually the kind that curate the background conditions necessary for what Joseph Schumpeter called creative destruction. A genuinely “entrepreneurial government” is not one that picks winners but one that clears obstacles from the path of private entrepreneurship.

RICHARD LANGLOIS

Professor of Economics, University of Connecticut

On its face it seems unlikely that bureaucrats in Stockholm and Brussels and Washington are good at choosing winners. The economic history is not encouraging. But if you still hope they might be entrepreneurial, and if you are willing to consider elegant economic science marshalling novel data to explore the hope, you need to read this book. In fact, everyone concerned about innovation, entrepreneurship and growth should.

DEIRDRE MCCLOSKEY

Distinguished Professor of Economics, History, English, and
Communication at the University of Illinois at Chicago

Despite their many differences, the U.S. and Sweden have followed similar paths to successful innovation. *Bureaucrats or Markets in Innovation* shows that – in both countries – for-profit entrepreneurship has delivered a massive wave of valuable new ideas and products. Giving governments more power to help “spur” innovation is a solution in search of a problem.

BRYAN CAPLAN

Professor of Economics, George Mason University

In one of the most interesting economic articles of the past two decades, Jeremy Greenwood and Boyan Jovanovic (1999), argued that the arrival of the information technology revolution in the 1970s created the need for new firm. The technology breakthrough favors new firms for three reasons: (1) awareness and skill; (2) vintage capital; (3) vested interests. The stock market incumbents of the day in both Europe and the United States were not ready to implement the new technologies and it took new firms to bring the technology to market after the mid-1980s. Stock prices of incumbents fell immediately. New capital flowed via venture capital to the startups that built the new industries.

One of the outcomes of this revolution was the restructuring of the traditional field of industrial organization that focused primarily on large firms to startups. The creation of new fields more closely organized around technology, innovation, entrepreneurship, economic geography and organizations to explain the role of new technology and the need for new firms. While this happened in the United States (Google, Amazon, Apple, Facebook, Uber) it did not happen to the same extent in Europe. Why not?

The answer to this question can be found in part due to deficiencies in the two major conceptual frameworks emerging in the 1990s to explain the evolution of this technological revolution. The first was the National Systems of Innovation framework. The main theoretical underpinnings were that knowledge is a fundamental resource in the economy, that knowledge is produced and accumulated through an interactive and cumulative process of innovation that is embedded in a national institutional context. National systems assumed that all of this takes place in existing firms, so there is no role for new firm or entrepreneurship to bring the technology to market. The second concept framework was Porter's Diamond that defined a system of regional clusters that propelled a country to prominence. The Porter Diamond put the emphasis on supporting institutions that may be missing in a cluster that are needed to incorporate new technologies. However, the Jovanovic insight was missing.

Clusters and National Systems of Innovation had two assumptions in common. First, *they both argued that institutional embeddedness was important and second, they both relied on existing firms to implement and deploy the new technologies!* Both of these approaches had a large theoretical literature, empirical research and policy recommendations. Because they both *left out of their analysis the role of new firms* that was Jovanovic's great insight they were limited in their usefulness for implementing the new information technologies. Why new firms were left out of these approaches is a subject in and of itself.

However, while the approaches did not have a large following in the United States they were immensely popular in Europe, especially National Systems of Innovation. The National Systems approach was in part a Swedish discovery and helps explain both the Scandinavian disdain for startups and the European Union's unwillingness to view innovation and entrepreneurship in the same unified approach. This theoretical misstep set Europe on a false path in the late 20th century and still haunts Europe as it falls further and further behind the United States and China in the digital age.

This important new book by Sandström, Wennberg and Karlson takes us a long way to try and bring Europe back to the realization that new firms and the financing of them is fundamental to productivity and economic growth.

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ZOLTAN ACS

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Foreword

Innovation policy matters

Innovation is the discovery and application of new knowledge to create economic value. It is the fundamental driver of economic growth and prosperity (Mokyr 2016; McCloskey 2016).

Yet incredibly, there is actually little consensus about the underlying economic theory of innovation and the implications this has for policy.

This is why some new Swedish empirical research evaluating firm-level outcomes of innovation policy experiments matters. The findings presented in this book help us better understand what is, perhaps, the most fundamental question in economics: namely on the origin of wealth and of the role of government in facilitating that.

Innovation policy (which is in reality a complex and contested suite of industry policy, research policy, science and technology policy, tax, regulatory and fiscal policies, intellectual property, higher education and skilled migration policies, among others) is increasingly the lodestar of modern economic policy. On a long enough time-frame, it is the only economic policy that matters. That is why new empirical investigations of its effects, and new theoretical models of its mechanisms, are of prime importance to policy discussion.

Innovation policy and its discontents

Modern innovation policy is broadly based on the economic theory of *market failure* in the incentives to produce new ideas and knowledge (Arrow 1962; Martin and Scott 2000). This mainstream economic theory explains why a free-market system will undersupply the economic good of ‘innovation’, or specifically the level of private investment in producing new knowledge, from a social welfare perspective.

Market failure theory defines the innovation problem as an allocation problem that can be resolved through various instruments to correct the misallocation of resources, such as through direct public support (e.g. public science or government grants), indirect subsidy (R&D tax credits), or by creating high-powered incentives for private investment (e.g. through intellectual property rights). The overarching policy idea through, based squarely on economic theory, is that innovation has *public good* characteristics, and therefore needs to be publicly supported. And that in the absence of such government support, innovation will be undersupplied, and consequently economic growth will be retarded, with enormous social welfare implications.

The problem, however, is that the evidence is rather mixed and selective. An authoritative OECD survey (Box 2009: 5) finds that “it is unclear whether the social benefits [of R&D tax support] outweigh the costs”, and using cross-country comparisons finds little evidence that innovation policy actually affects aggregate economic growth rates.

A long line of influential work, beginning with Vannevar Bush (1945), has argued that government support for basic science is necessary to create new technologies and industries. Recently, Mariana Mazzucato (2013) has argued that most of the technology in the Apple iPhone was the product of publicly funded research, inferring that without public support we wouldn't have the enormous economic and societal benefits of smartphones. But that confuses invention with innovation. The innovation of the iPhone and its social and economic value was an entrepreneurial discovery. The value was discovered in the marketplace, not in the laboratory.

Market failure theory assumes that ‘the innovation problem’ is in essence an allocation problem in funding R&D. The policy implication is that the misallocation (compared to the social welfare optima) can therefore be resolved with a reallocation of scarce economic resources. This offers a clear role for government in *supporting innovation* by targeted spending of public resources.

However, there is growing evidence that support of innovation is not the main economic problem. Scholars of open innovation (e.g. von Hippel 2005), knowledge commons (e.g. Frischmann *et al* 2014), and intellectual property (e.g. Boldrin and Levine 2007) emphasise that organisations and markets regularly work their way around knowledge investment and appropriation problems.

What is emerging instead is a new theoretical approach to the innovation problem that emphasises coordination and knowledge problems rather than resource allocation problems, and that draws on Public Choice theory, Austrian market-process theory, and New Institutional economics (see e.g. Allen and Potts 2016; Davidson and Potts 2016; Potts 2014, 2018, 2019).

These new theoretical models emphasise that the economic problem is discovery of value not invention of new technology, and so they focus on the innovation problem in a market context, rather than on the invention problem in an organisational context. The new approaches emphasise the role of entrepreneurship in the market discovery process and the role of institutions to coordinate such discovery, and they focus attention on the barriers to innovation that come from within the economy, particularly regulatory and political constraints. They find that innovation resources are more than just the technical details of an invention but also crucially include market information about the nature of the entrepreneurial opportunity.

The problem with innovation policy

A nice property of modern innovation policy is that, conceptually at least, it has a clear and simple rationale, namely to correct market failure in producing new ideas through some form of *targeted public spending*, whether as tax credits, subsidies, grants or loans.

In practice, however, the problem is that targeting is far from easy. It's hard to figure out who, exactly, is experiencing the market failure, where it is specifically manifest, and with what

consequence. And even if those factors were unambiguous, delivery of support involves measurement problems, information problems, design problems, knowledge problems, and agency problems. It is clear what to do in general, yet hard to know what to do in particular. Furthermore, the attempt to address these accountability problems through processes and rules creates further risk of perverse or misaligned incentives in pursuit of these rents. Which is to say that government itself creates a lot of the costs and barriers that entrepreneurs face in seeking to introduce new ideas (Lougui and Nyström 2014).

So, we ought not be surprised when evaluations of innovation policy interventions find evidence of only temporary positive effects (Gustavsson Tingvall and Deiacco 2015, Gustavsson Tingvall and Videnord 2017). Or that the subsidies and rents themselves distort firm behaviour, such that firms begin to specialise in getting grants rather than in discovering market opportunities. They become ‘subsidy entrepreneurs’ (Gustafsson et al 2017). These knowledge problems mean we ought not be surprised that the state has no better track record in venture capital funding, and indeed, given its political incentives in the allocation of capital, actually has a worse record (Engberg et al 2017). Market failure theory is difficult to apply in practice and as the Swedish empirical studies confirm, often results in policy failure.

So, what is to be done instead?

Friends and enemies of innovation

Modern innovation policy enacts the idea that if you want more of a thing then you find those doing the thing and support them with resources. You advance easy credit, afford them tax breaks, subsidise their costs. Call this the ‘support your friends’ approach.

But another way to advance innovation is to target the things that are against innovation (Juma 2016). Call this the ‘engage your enemies’ approach.

Enemies of innovation expect to be harmed by a specific new innovation and thereby seek to stop its progress or mitigate

its effect. They are not necessarily anti-new technology or anti-progress but are against *this* specific new technology or innovation (e.g. horseless carriages, synthetic biology, artificial intelligence, driverless cars) because of specific concerns about the harms that *this* particular innovation will bring to them. Friends of innovation focus on the benefits of innovation for the many. Enemies of innovation focus on the costs to the few.

The ‘help your friends’ approach to innovation policy is politically popular, with concentrated benefits (among politicians, government agencies and business firms) and diffuse costs (over taxpayers and entrepreneurs). Your friends will value your support: they will vote for you, say nice things in the media. The ‘help your friends’ approach is also sensible from an aggregate public welfare perspective, given the overarching net social benefit from innovation.

But ‘engaging enemies’ is often what is actually needed. Innovation means that people adopt new ways of doing things. This devalues old ways of doing things, writing off the skills and capital investments that had been sunk into those. From this perspective it is for some people individually rational to oppose a particular new technology, to worry about job loss, or public safety, and to imagine catastrophe. This rent protection raises the cost of the new innovation, reducing its supply.

A better and more practical form innovation policy lies in brokering ‘grand Coasean bargains’ paying-off or trading out regulatory protections or other rents in order to get the enemies of innovation to stand down, or to accept a broader social compact that minimises rent creation and lowers the cost of innovation for anyone.

What this looks like in practice is less attention to targeted innovation support (i.e. spending), and more attention to minimising the costs, frictions and distortions in the business environment (i.e. deregulation). Note this involves clear long-term thinking and hard political bargaining (i.e. politics), and not just short-term politically-delivered economic support.

Effective innovation policy should aim to enact broader reforms making it easier to run businesses. Innovation means doing new things, and reducing the costs of introducing new ideas, of starting new businesses, transferring capital assets into new purposes, finding and hiring new staff, and creating new business models. Fixing these problems is less about supporting innovators by pushing public resources to them, but rather about lowering costs and reducing barriers to doing new things. The best innovation policy is a good business environment.

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1. Summary

How can innovation best be promoted? This is a question that developed and developing countries alike seek to answer in order to enhance competitiveness, productivity, employment, and growth.

In a major interdisciplinary research program, the Financing of Innovation (2013–2018), at the Ratio Institute in Sweden, critical conditions for innovation have been studied in a systematic way, combining detailed quantitative modeling of all Swedish companies with a large number of case studies. Echoing international studies on the same topic, results show that innovation policy needs to focus more on supplying the right competencies and on improving the institutions of the market economy rather than on various targeted interventions such as financial support or research and development (R&D) subsidies for particular types of firms. Markets rather than bureaucrats are thus decisive for an innovation policy for growth.

Innovation is about the commercialization of new knowledge through entrepreneurship. Hence, favorable conditions for new firms and well-functioning markets are central to innovation policy. The evidence suggests however that a lack of financial capital is not the biggest problem for (new) innovative companies. Since the major sources of “competent” capital evident to spur the creation and growth of new innovative companies comes from founder(s)’ own savings, business angels, or venture capital (VC), lower taxation on entrepreneurship and personal incomes produce more “competent capital” than various

types of subsidies. Further the effects of direct public support for companies seldom match the expectations of policymakers. Instead, political attempts to solve alleged market failures often create various type of policy failures such as skewed incentives, unfair competition and regulatory capture.

Our studies show that, in Sweden, the greatest potential for enhanced conditions for innovation comes instead from (a) improving the general institutional conditions of market-related competitive conditions and the supply of human capital and skills (“competence”) through a better-functioning labor market and educational system, (b) moderating the frequently increasing regulatory burden, and (c) addressing infrastructure problems.

Generally, policy focus needs to shift away from an input-based logic toward an output-based logic. Instead of focusing public support on what is presumed to lead to innovation, policy should prioritize overseeing the basic institutions of the market economy and removing various obstacles to innovation. Instead of maintaining a large and expensive bureaucratic system of governmental subsidies for private firms (“input-related” policies), more emphasis is needed on attending to “outputs” in terms of growing the number of innovative firms and their impact.

An innovation policy for growth must put greater emphasis on entrepreneurship and the overall institutional conditions for enterprises. A reform process with such a focus would undoubtedly yield much stronger long-term improvements in the innovative capacity of the Swedish economy.

2. The Financing of Innovation Research Program

This book is based on the results of Ratio's research program *Financing of Innovation*, which conducted a large number of studies on the condition of innovativeness and growth in both new and established firms. The purpose was to investigate the economic and legal challenges facing innovation and growth-oriented entrepreneurship. The program was founded on a comprehensive empirical base with studies of companies at different development phases with an interdisciplinary perspective based in economics, finance, law, and management studies. Research questions include: How can the interaction between financing and entrepreneurship be improved to facilitate innovation, competitive production, and long-term growth? Which legislation is appropriate in the different phases of development of companies? Are public support and financing systems effective? The program ran from 2013 to 2018 and produced 49 scientific articles, 17 working papers presented at conferences and symposia, and 18 reports, books, or book chapters, within the framework of the program's five sub-areas:

1. Financing of new and fast-growing companies
2. Financing of disruptive innovation
3. Public support and innovation
4. Legal aspects of financing of innovation
5. Corporate governance and innovation

A complete list of all scientific references is available at the end of this book.

The program was supported by a steering group of experts and decision makers from various stakeholders in innovation processes and entrepreneurship, including representatives of government authorities, commercial banks, VC companies, business organizations, and inventors. The main financier of the program was Vinnova, Sweden's innovation agency. All studies and conclusions provided are of course those of the authors alone.

The continuous dialogue with these and other key stakeholders represented an important part of the program. Entrepreneurs, innovators, top executives, politicians, and other decision makers contributed practical insights and broadened perspectives on a continuous basis. A total of 25 open conferences and seminars were arranged. Ratio's researchers in the program also participated 131 times at external lectures and conferences, and results from the program have been mentioned in the Swedish media 127 times.

What general conclusions can be drawn from such an extensive research program? How can the interaction between financing and entrepreneurship be improved to facilitate commercialization of new knowledge and innovation that can increase competitiveness, jobs, and growth? What other conditions are essential in strengthening development, entrepreneurship, and innovation in Sweden?

The introductory chapter 3 of the book describes the general need for a more innovative economy in the modern Swedish welfare society, as well as various theoretical and political perspectives on how such a development can be achieved. The chapter provides a cursory theoretical overview of how innovations emerge and spread, and what role public policy can play in these processes. Here, we derive three critical conditions for successful innovation, namely *capital*, *competence*, and *institutions* (laws, rules, and social norms related to entrepreneurship and innovation in society). We devote a chapter to each of these

critical conditions (chapters 4–6) where we also discuss international evidence of public policy interventions targeting entrepreneurship and innovation. Chapter 7 provides a summary and conclusions drawn from the research program. At the end of the publication there is a list of the articles and reports produced within the framework of the program.

We would like to thank the financiers who have contributed to this research program. In particular, Vinnova has both assisted Ratio with funding and input as well as important initiatives in the development of research on public support schemes. Vinnova also generously funded Ratio's earlier Skills for Growth program, where ideas on the importance of competencies for innovation and entrepreneurship initially emerged. We also want to thank the steering group of the program, as well as the many people providing input on each of the specific research projects – too numerous to name everyone here. Our deepest gratitude is directed toward all the researchers who have been involved in the program. A special thanks goes to Anders Gustafsson and Christoffer Rydland who contributed valuable comments on the manuscript and reviewed parts of the international research literature in the field, and to Samuele Murtinu who provided helpful criticism. We are also indebted to Klara Hvarfner for editorial assistance.

3. Innovation, Entrepreneurship, and Prosperity

Like many industrialized economies formerly dominated by large manufacturing firms, the Swedish economy has undergone a transformation in recent decades and in some respects become very entrepreneurial. During the past decade or two, Sweden and in particular Stockholm have seen more “unicorns” per capita – companies with a market value of more than USD 1 billion – than any other region outside Silicon Valley. Companies like King (Candy Crush), Skype, Klarna, iZettle, Northvolt, and Mojang (Minecraft) highlight the significant presence of high-technology start-ups. Today, more than 20,000 such “tech firms” exist in greater Stockholm. The growth of the technology sector is also mirrored in its occupational structure where the single most common occupation in Stockholm today is that of software engineer. Around 18 percent of all VC investments in “fin-tech” (financial technology) in Europe since 2009 have come to Stockholm (Wharton 2015).

Sweden also performs well in various international comparisons with respect to innovation capacity. In June 2018, the European Commission published its European Innovation Scoreboard, which measures how innovative different economies are within the Union and between countries. As usual, Sweden ended up among the highest-ranked countries. However, the results have been criticized by several researchers, including Charles Edquist and Jon Mikel Zabala (2018), who claim that the European Commission does not actually measure *innovative*

output but different types of *input factors*. Public investment in, for example, R&D or primary education are of course important preconditions for innovation. These can be seen as crucial public investments, but do not in themselves indicate the presence of innovation and economic change. According to Edquist and Zabala, the EU Commission combines inputs and outputs into a simple mean value, which becomes misleading as an indicator with excessive weight attributed to costs instead of results. In Sweden, as well as in many other European countries, significant resources are spent on what is expected to lead to innovation, but this allocation of resources does not necessarily translate into more innovation and entrepreneurship.

Such significant investment in R&D without seemingly sizable effects on realized outcomes has for a long time been called “the Swedish paradox.” Previous research suggests that Sweden appears to have problems in two areas: the entrepreneurial climate and innovation-led high-tech production (Edquist & McKelvey, 1996). Kander and Ejerme (2006) believe these conditions stem, first, from Swedish R&D still being disproportionately conducted in only a few multinationals – in itself an indication of weak entrepreneurship – and, second, Sweden continuing to lag behind the OECD average in medium- and high-tech exports, although it is catching up. Given Sweden’s very high R&D intensity, this prevailing relative scarcity of high-technology start-ups and exports of medium- and high-technology products indicates that *bottlenecks for innovation do not come from a lack of innovative inputs*, but rather somewhere else in the economic system.

Innovation as an increasingly important engine of growth

What is meant by innovation and what is its connection to entrepreneurship? Our point of departure here is Joseph Schumpeter’s (1934) assertion that economic development is a result of innovative entrepreneurship, that is, commercialization of new, productive knowledge in a broad sense. In this sense, *innovative out-*

comes can rather be regarded as innovations being commercialized on an industrial scale (Dahmén, 1950).¹ For this to be possible, the business and legal conditions set by the state must be effective, not only for entrepreneurs, but also for complementary actors such as venture capitalists, industrialists, a labor force with adequate education and work experience, and customers (Eliasson & Eliasson 1996). Fundamentally, this is about allocating different types of competencies across related sectors and markets efficiently. Especially important are competent investor-owners who can provide both financial capital, knowledge, and social network resources (Gompers & Lerner, 1999).

An innovative industry enhances productivity and strengthens the competitiveness of the economy, that is, its capacity for renewal and adaptation (Johansson & Karlson, 2006). “Innovation” is here defined as something new – a product, process, or business model – of commercial value. “Entrepreneurship” is about the process of identifying opportunities for these to be developed and realized in the form of growing companies (Drucker, 2014). Briefly, innovation is about commercializing new knowledge.

In a 1950s study, Stanford researcher Morris Abramowitz (1956) showed that only 15 percent of US economic growth over the period 1870–1950 could be explained by an increase in traditional factor input (land, labor, capital). The remaining 85 percent of the increase was linked to something else in the form of increases in productivity in different parts of the economy. In other words, new manufacturing methods, new technologies, and new ways of organizing activities had accounted for a significant part of US prosperity, even during an era that was in all likelihood more industrial and commodity-related than today’s economic growth. Similar findings regarding the importance of innovation have been confirmed by other researchers, such as the Nobel laureate Robert Solow (1957), and these studies,

1) For micro-evidence on innovative inputs vs. innovation outcomes, see, for example, McKelvie et al. (2017).

among other things, form the basis of a field in economics called *endogenous growth theory*. Scholars such as 2018 Nobel laureate Paul Romer (1990) have in recent decades worked to develop models of economic development that reflect the fact that a significant part of economic growth actually comes from innovation and changes in human capital rather than the consumption of more natural resources.

There are plenty of illustrative examples of the link between innovation and prosperity to date. For example, in relation to digital technology, with the electronics of the 1940s, the computer power in a modern smartphone would have required a computer the size of more than 200 buildings and consumed 50TW energy. With such energy consumption, a phone battery would have run out in less than a nanosecond. In the early 2000s, the Stockholm Stock Exchange had a daily turnover of around SEK 20 billion. Annual turnover was around SEK 2 billion in the 1970s. In other words, the entire 1970s volumes were traded in one day. Productivity measured as turnover per unit of time would thus be about 2,600 times higher in the early 2000s than in the 1970s. Such progress can only be made possible by innovation, in this case in the form of the emergence of a completely digital and (later) privatized stock exchange (Jörnmark & Ramberg, 2004; Cheung, et al., 2017).

In a world characterized by international competition from low-cost countries and developed economies alike, innovativeness represents a central competitive edge. Companies that do not renew their offers to the market or streamline their processes tend to face price competition, with eroded sales and declining margins as a result. In Sweden, both historical and contemporary export successes are in many cases based on innovation. Astra became a global company with the help of the gastric ulcer drug Losec, and Axis was the first in the world to launch a network-based video camera in 1996, a product innovation that made the company a world-leading actor in the security industry (Berglund & Sandström, 2017). Victor Hasselblad's one-eyed

mirror camera laid the foundation for the company Hasselblad, and Volvo's investments in safety and quality gave the company a strong international position during the 1960s and 1970s, partly thanks to the diagonal seat belt.

In an economy characterized by mounting competition and technological turbulence, firms need to manage and measure innovation systematically (Richtnér et al., 2017) and the absence of sufficient innovation is quickly translated into struggling performance. The Swedish pharmaceutical industry is facing patent expiration and have not yet succeeded in creating new drugs that fully compensate for this. Nokia's mobile phone business collapsed in the transition to smartphones, and Ericsson has encountered major problems in recent years due to increasing competition from, among others, Chinese Huawei.

Innovation is also essential to the labor market and wage formation. New technology and new ways of organizing businesses lead to increased employee productivity, which means that there is room for real wage increases. More recently, the effects of digitalization on the labor market have been described as negative in the sense that jobs disappear. This is misleading as it is not professions or occupational groups that disappear, but rather specific *tasks*. Time is then freed up for employees to devote their efforts to other, more value-creating activities such as qualified services (McAfee & Brynjolfsson, 2015). Traditional industrial companies such as Swedish SKF (ball bearings) and Ericsson are today largely knowledge-intensive product and service companies where services generate an increasing share of the profits. Increased efficiencies lead to lower prices for customers, higher salaries for employees and, at least in the short run, higher company profits. In the longer run, competition between new and existing companies subdues profits and keeps the companies investing in innovation to maintain their competitive advantage, with positive societal outcomes (Aghion et al., 2009). As an example, as the hearing-aid industry recently moved from manual manufacture of earplugs to 3D-printed

products and customized production software, several companies were able to increase their productivity by a factor of eight, at the same time increasing product quality and improving their companies' profitability (Sandström, 2016).

A large theoretical and empirical literature on competition and productivity illustrates that innovation-driven industry dynamics is the most important factor behind growth and productivity development (e.g. Aghion et al., 2009). The fact that companies can both enter and leave a market is something that drives productivity forward. In other words, productivity increases are mainly due to high-productivity companies taking market shares from companies with lower productivity (Jovanovic & MacDonald, 1994). Thus, exit of unproductive firms and the "creative destruction" instilled by new entrants are both essential elements in achieving higher productivity (Caves, 1998).

However, the productivity gains of innovation can lead to higher unemployment, where not enough new jobs are created in other parts of the economy. In a study from 2009, two Ratio researchers showed that not a single new job had been created in the private sector in Sweden during the period 1950–2005 (Bjuggren & Johansson, 2009). Put differently, the high rate of transformation that characterizes today's business means that old jobs are disappearing rapidly, but that this decline has not been mitigated by the creation of new firms and jobs.

Other studies at Ratio have shown that new jobs tend to be created in fast-growing companies rather than in mature and established companies (Coad et al., 2014). There are also international studies showing that smaller and growing companies account for a significant share of the more groundbreaking innovations in an economy (Acs & Audretsch, 1988). New companies also seem to have a particularly prominent role in industries dominated by a smaller number of large incumbent firms. It is therefore clear, not only that innovation is important, but also that entrepreneurship is essential in realizing opportunities for economic renewal.

But how do innovations come about? Clearly, entrepreneurial ventures play a key role in bringing innovations to market, but new productive knowledge can also arise elsewhere, such as at universities and colleges and in large or small companies.

Previous research in this area has shown that universities account for a relatively small part of the innovation in an economy. In a historical study of pioneering innovations in the United States during the first half of the 20th century, it was shown that the majority of these were created by entrepreneurs and small companies (Jewkes et al., 1958). This is remarkable, especially considering that the large companies of the time built their own extensive research laboratories. Later studies have confirmed the picture that smaller and growing companies account for a significant share of new innovations and, above all, the more pioneering innovations (Acs & Audretsch, 1988).

Does publicly funded research not play a part in creating new innovations? Out of the 100 American innovations rated most prominent by *R&D Magazine* annually, only about 6 percent came from universities (Block & Keller 2008). Granstrand and Alänge (1995) studied 100 significant Swedish innovations during the period 1945–1980. According to their data, 80 percent of these innovations could be derived from large companies, while the remaining 20 percent came from small companies and independent inventors. Of these innovations, Granstrand and Alänge showed that universities were involved in just less than 20 percent.

Sweden thus seems to follow the same pattern as the United States where the business sector accounts for the greatest share of innovation, but with a greater dominance of large established companies. Publicly funded research instead seems to have a more indirect role, in that results from basic and applied research alike spread more slowly through teaching and individuals who move between research institutes and business (Almeida & Kogut, 1999; Audretsch & Keilbach, 2005; Sandström et al., 2016; Wennberg et al., 2011).

There is also a large academic literature on the universities' and companies' innovation propensity which is based on patent data. Although inventions and patents are not strictly the same as innovation, the literature gives an insight into where innovative activity tends to occur in an economy. Here too, the role of universities appears to be primarily indirect, although it has become more prominent over time. In a study by Ejermo (2011), it was demonstrated that most inventors were found in the manufacturing industry. Ejermo's study shows that, in 2004–2005, there were 1,567 inventors in the manufacturing industry compared to 190 in academia, that is, more than eight times more in manufacturing.

However, US universities' share of patents increased during the late 1990s from 1.5 percent (1975) to 2.5 percent (1988), an increase that has continued as commercial revenues have become more important in financing universities and colleges (Henderson et al., 1998). A similar pattern can be seen in several European countries (Lissoni et al. 2008) where university patents tend to be more common in chemistry, biochemistry, medicine, and similar subjects. The universities' share of the total amount of patents was between 4 and 6 percent in France, Italy, Sweden, and the United States. In a Swedish doctoral dissertation from 2013, Bourellos (2013) estimated that universities accounted for approximately 6 percent of the patents in Sweden (Bourellos, 2013), approximately the same proportion as the share of prominent innovations in the United States (Block & Keller, 2008).

Does the increase in university patenting universally lead to more innovation and entrepreneurship? Not necessarily. The sprawling literature on university–industry collaboration – often called “academic entrepreneurship” – highlights that the majority of university patents are commercialized by private companies, given universities' significant information asymmetry when seeking to gauge the commercial value of their ideas. Universities around the globe have set up technology transfer

offices (TTOs), university incubators, and sometimes university-sponsored/managed VC funds to increase the rate of inventions that are commercialized. Yet, the literature suggests that those TTOs that are effective often tend to be so due to non-university factors such as the regional level of VC and skilled labor, or factors rather unrelated to the creation of these institutions such as the overall quality of the academic institution and its research (e.g. Chapple et al., 2005; Clarysse et al. 2011; Croce et al., 2014; Mowery et al., 2015). Further, rigorous studies comparing university start-ups supported by university incubators in different countries with similar firms started without such “support,” rather unanimously show that university incubators are not very effective at enhancing the prospects of start-ups (e.g. Amezcua et al., 2010; Ejermo, 2018; Lukes et al., 2019; Schwartz, 2013). Why is this? Kolympiris and Klein’s (2017) study of a large number of US universities provides a clue by finding that, when a university-affiliated incubator is started, it is often followed by a reduction in the quality of innovations and licensing income for the university. This indicates that university incubators compete for resources with TTOs and other campus programs and activities, meaning that the useful outputs they generate can be partially offset by reductions in innovation elsewhere. But where do the new innovations emerge from, then?

Sandström (2014) studied 100 of Sweden’s foremost innovations created by individual entrepreneurs, by established companies or by universities. The results are similar to the studies presented above: The overwhelming majority of innovations came from the business community, and universities had a more limited role. In this study, forty-five percent of the innovations came from established companies, 35 percent from individual inventors who started companies, and the remaining 20 percent emanated from universities. Of the university innovations, the overwhelming majority were found in medicine and health. Sandström’s (2014) results indicate that commercial industry and independent inventor-entrepreneurs dominate when it

comes to innovations that become commercially successful on a large scale.

To sum up, entrepreneurship and innovation, that is, commercialization of new productive knowledge, are crucial for development, productivity, prosperity, and job creation. Although Sweden performs well in some respects, it is clear that significant development potential remains to be realized.

Challenges of innovation policy and innovation systems

A narrow interpretation of the above results would imply that market actors, in particular private firms, are vastly more important for innovation than universities. This, of course, would be an oversimplification as private firms – new and established alike – rely on universities for recruiting skilled personnel, commissioned research projects, etc. Tracking and understanding the origin of innovation is a complex issue that requires a broader and more systematic approach. Here, then, the role of policy needs to be discussed.

The state can be more or less active in fostering innovation and focus on indirect as well as more direct policies. A large international research literature on so-called “innovation systems” has emerged over the last few decades to discuss these issues. Several Swedish researchers have been involved in this field, which is sometimes called Innovation System Studies (e.g. Edquist & Johnson, 1997; Bergek et al., 2008; Lundvall, 1992, 2010). The literature today is extensive and has moved in different directions, but there are several different schools of thought sharing different views on the role of policy and the importance of entrepreneurs. One common feature is to emphasize the systematic and evolutionary nature of innovation, the complexity of how related systems of actors evolve, the need for cross-border collaboration, and the resistance of established interest groups and institutions.

According to the Systems of Innovation approach, system thinking or a system-wide approach is essential. Innovation

systems, which exist at both national, regional, and local levels, comprise actors who all have different roles in a coherent system. This theory posits that absent links in the system create problems. Both politics and the market are important, although the importance of entrepreneurs is usually underscored. A different, partially complementing version of the same thinking is at times referred to as the “Triple Helix,” where three central actors are identified: universities, authorities, and private companies. The overarching idea is that collaboration between these actors is crucial for the strength of the innovation system (Etzkowitz, 2000; Etzkowitz & Leydensdor, 1995).

Some research, however, questions this approach as being too “top-down” and as a consequence it fails to capture the importance of well-functioning market mechanisms and incentives for private entrepreneurs in the emergence of innovation (Baumol, 2004; Elert et al., 2019; Woolthuis et al., 2005). A fundamental idea in this approach is that the role of policy should focus on overseeing the functionality of basic institutions of the market economy and to ensure that different forms of “bottleneck” disappear. Those bottlenecks could be anything from the basic educational system, the taxation system, regulations on new firms, supply of VC, etc. (Acs et al., 2012; Borrás et al., 2009; Elert et al. 2012). From that perspective, the innovation system is less something “designed” or “moldable” by top decision makers but rather grows organically, “bottom-up” from the actions of entrepreneurs and inventors. Similar assumptions can be found in the literature on Evolutionary Economic Geography where competition among individual companies, often clustered together with similar and complementary companies, forms the basis of innovation and growth (e.g. Nelson & Winter, 1982; Rigby & Essletzbichler, 1997 Boschma & Lambooy, 1999).

The fact that markets and entrepreneurship are important for innovation does not necessarily imply that the government should support these actors; it may be enough just to ensure that competition is fair and no monopolies are created. There are,

however, theoretical reasons why innovative work in an economy may be underfunded. Certain types of knowledge production, such as long-term investment in R&D, fulfill the criteria of being a public good that is difficult to finance privately. The development of new research is associated with costs, while the benefits can be appropriated by many actors where anyone can use the resource (Acs, 2002). This is a type of positive externality in that knowledge “spills over” to a wider variety of actors. This is known to benefit society and economic development but comes at a cost borne by the actor creating the new knowledge. There is, therefore, a risk that some actors free ride on others who, in turn, will be less likely to invest in R&D (Arrow, 1963). This means that there is a risk of a suboptimal amount of R&D in a society that then comes to rely solely on profit-maximizing companies and the free market.

This explains why it may be difficult to attract private funding for R&D (Hall & Lerner 2010). R&D is inherently risky, and it is common for projects to fail. The high risk, and the difficulty of properly conveying information about an R&D initiative (which is often technically complex and specific for the individual company), means that traditional financing opportunities such as bank loans can be difficult to secure. Moreover, it is generally difficult to use knowledge from an R&D project as a guarantee for a possible loan, one exception being cases where R&D investments have resulted in patents that can be commercialized and sold (Ullberg, 2015).

Further, the introduction of innovations is rarely a painless process. In order for new structures to be able to grow, old structures, in the form of companies, competencies, and institutions, need to change or, in some cases, be removed completely. Innovations that lead to redundancies or the loss of competitiveness often result in conflicts. Schumpeter coined the term “creative destruction” (Schumpeter, 1942) to describe how innovations lead to structural transformation. Not infrequently, these conflicts cause innovation to be blocked by incumbent firms and

actors with a vested interest in the old way of delivering goods and services (Potts et al., 2016). For the innovation capacity of a country it is therefore crucial to handle the tensions that exist between established interests and new ones constructively, through antitrust policy (scrutinizing and avoiding the creation of monopolies) and regulations that encourage new firms to enter existing industries as key mechanisms of the state.

Some research has emphasized the importance of public initiatives to both finance the development of new innovations and ensure that innovations do not get stuck in different structural locks in the economy (Mazzucato, 2015). These researchers often have a Keynesian perspective when arguing that innovation processes require government intervention. Capital markets are assumed to be inefficient and are characterized by different types of market failures that justify public efforts as support for innovation. We will return to this question in the next chapter.

There are several examples of countries that have achieved economic growth through a more active or interventionist industrial policy. Taiwan built up a world-leading semiconductor industry, partly through a combination of state-owned, publicly funded technology imports (mainly from Silicon Valley) and the formation of technology parks (Saxenian, 2002). The Japanese development model during the post-war period was also clearly characterized by public initiatives. Through the Ministry of International Trade & Industry, both exchange rates and technology development were controlled in tandem with business and industry, while domestic industry was protected from foreign competition. However, it is unclear to what extent this contributed to the Japanese economic miracle (Okimoto, 1989). Japan has been in long-term economic stagnation since the 1980s, and a lack of entrepreneurship has been emphasized as one of the main problems. A more contemporary example is the small country of Singapore which, with few domestic resources, has developed over the past 40 years into one of the world's leading economies with high economic prosperity. Free trade, major in-

vestment in the secondary and tertiary education sectors with a focus on both breadth and excellence, and active retrieval of technology and knowledge from developed countries with low taxes and generous working conditions for international expertise, are just some of the suggested recipes for success.

There are also examples of how costly and, in the short run, unprofitable R&D has been subsequently successfully commercialized by private companies. AT&T's Bell Labs in the United States is one of the most famous examples in this field where, among other things, researchers invented the transistor, the laser, radio astronomy, the image sensor, and several programming languages – no less than eight Nobel Prizes to date have been awarded to Bell Labs. During the 1970s, several of the information society's building blocks were developed at the Xerox Palo Alto Research Center (PARC), such as laser printers, the modern PC, graphical user interfaces, object-oriented programming, and advanced semiconductors. Kodak Research Labs is behind several of the technologies that have been crucial for the development of digital photography, including the first digital camera in 1975 and the world's first megapixel sensor in 1986 (Paxton, 2012). Large Swedish companies have also devoted themselves to significant and long-term development work. For instance, Astra's development of world-leading drugs such as Losec and Xylocain was a long and costly process spanning many years, Ericsson developed the AXE system with electronic switches, as well as Bluetooth and several other technological innovations within telecom.

How, then, have private companies managed to finance the innovation work that, at least in theory, is a public good? There is no clear answer. In the cases of Bell Labs and Xerox PARC, there were large profits from the core business that could be invested generously in various development projects. At the same time, it is evident how often these organizations failed to reap the rewards of their innovation work. Researchers at Bell Labs had to leave the organization in order to continue working on

the transistor. Although Eastman Kodak developed digital photography and had thousands of talented engineers, they failed to complete and realize the value of their technological achievements. It should also be pointed out that R&D can only partly be understood as a public good: R&D is frequently embedded in machines and brands, customer relations, and different processes, often in such a way that other actors cannot replicate anything fully. Replicability differs among innovations and sometimes established companies can commercialize an innovation despite a lack of intellectual property rights (Teece, 1986).

These examples suggest that private-sector actors often find ways to finance long-term, groundbreaking innovation, even if they themselves do not always manage to capture the rents that these innovations create. However, there are other examples of government intervention that suggest caution over such involvement. Harvard professor Josh Lerner's book *Boulevard of Broken Dreams* (2009) contains countless examples of unsuccessful active business and innovation policies around the world, ranging from abandoned science parks in Malaysia and EU funds distributed so widely through political deliberations that they could not make any difference, to incubators in Australia which themselves consumed a large part of the resources earmarked for entrepreneurs.

Fundamental information and incentive problems

The fact that innovation and entrepreneurship are important for the economy therefore does not necessarily imply that R&D or small business should be supported by the state. While there are theoretical arguments for state intervention, we can identify several factors that urge a more cautious approach.

One important reason is that policy, just like the market, can fail. An alleged market failure is not an adequate reason for political intervention: It also requires demonstrating that politics really can solve the problem in question, avoiding policy failures. As we shall see, this is an important challenge for inno-

vation policy. Challenges can be divided into problems of information and incentive (Karlson, 1993; Boettke and Leeson, 2004; Leeson and Subrick, 2006; Pennington, 2011).

Information problems concern the difficulty a public actor has in collecting the information and acquiring the knowledge that enable correct decision-making regarding, for example, the allocation of resources. According to many economists, it is practically impossible to aggregate information and knowledge about production conditions, business opportunities, customer preferences, etc. to a central unit in society. Instead, this information is scattered, local, and time-bound in character (Hayek 1945). For example, an investment decision is made by a particular individual, with specific expertise and with specific social networks. The considerations made by the individual cannot be measured or summed up and centralized in society. This is why a market economy is usually superior to a coordinated economy: The price mechanism provides aggregate information about customers' demand, and the companies' profits and losses. Information and knowledge are thus conveyed between market actors, and this information is hard to extract from its origin.

Industrial development in a market economy is often a complex evolutionary process. Through an experimental search process characterized by failures and unpredictable breakthroughs, the economy develops over time (Aldrich, 1999). Individual market actors make mistakes and invest in the wrong technical solution or the wrong business model for a new technology. Over time, adjustments are made continuously, and, through exclusion, new solutions are selected in a process that can be likened to Darwin's natural selection.

If the actors themselves who operate in a market are unable to know which technology or business model is optimal, there is reason to question how a public actor in the form of a government agency or a policymaker can perform this task satisfactorily. Government involvement in the form of "picking winners," that is, attempts to generate growth through government se-

lection of technologies or companies, risks becoming expensive for taxpayers. An example is how the municipality of Örnköldsvik in northern Sweden spent several billions trying to extract ethanol from cellulose, resulting only in municipal debt and an absence of economic growth. While the municipality continued investing and obtained more state funding for doing so, ethanol has since lost its appeal and instead electric cars are gaining momentum.

Incentive problems are about the driving forces of public actors. Are political decision makers and administrators really driven by the right incentives, or are their actions more about pursuing different types of self-interest, such as vote and budget maximizing, rather than promoting what is of public interest (in this case, innovation)? Such issues have been studied within *public choice theory* which has found significant support for the claim that politics is influenced by profit from special interests at the expense of taxpayers and the public (Buchanan & Tollison, 2009; Niskanen, 1975).

For example, different public programs tend not to be closed down, even when they have no positive effects. Government initiatives can also lead to companies developing opportunistic behaviors which, ultimately, can result in both cheating and corruption. Furthermore, even support or cheap loans are not free as they are always associated with a search process that requires personnel resources, both for the company and the administrative body. Competition may be distorted, and selective support can create skewed incentives where companies spend more time applying for grants and lobbying for support than they do developing their products and services (Baumol, 1990). Furthermore, there is a risk that politicians prioritize what benefits them in the short term rather than making decisions that benefit society in the long term. There is always a risk, then, that support schemes and an active innovation policy will be exploited by opportunistic politicians as well as authorities and companies. One example comes from recent developments

in Spain, where an overly supportive scheme for renewable energy resulted in a bubble of solar cells and wind power, as well as considerable levels of corruption. The support was so generous that growth became unmanageable for the government, which eventually had to withdraw the support it had assured would apply for years to come (Calzada et al., 2009). This shows that public initiatives for innovation are associated with both information and incentive problems.

To sum up, there are several theoretical arguments why a market's conditions would produce an insufficient supply of innovation, suggesting that policy efforts are needed. These are, however, associated with their own difficulties, both with regard to access to relevant information and current incentives. A functioning policy for growth therefore needs to strike a balance: Political failures may be as problematic as market failures.

Capital, competence, and institutions

To provide an analytical structure for the continued discussion of the challenges related to innovation policy, we focus here on three fundamental conditions for innovation: capital, competencies, and institutions. Contemporary models of economic growth are often based on a similar structure (Solow, 1957; Romer, 1990).

Capital is a prerequisite for investments in innovative operations and commercialization of new knowledge (Kortum & Lerner, 2001). The same applies to competencies. The importance of human capital for economic development is well documented in research (Becker, 1964). For innovation processes, *competent*² employees (in academic jargon: human capital) are particularly important. Further, it is not uncommon for radically new innovations to create entirely new requirements for competencies. Access to capital and expertise can ultimately

2) We use the term *competence* as the potential capacity of an individual (or a team) to handle certain situations or complete a certain task or job successfully, according to certain formal or informal criteria, set by themselves or by their employing organization (Ellström, 1998).

only create innovation if there are functioning institutions that enable commercialization of new knowledge. Here, *institutions* refer to laws, rules, and social norms related to entrepreneurship and innovation (North, 1990).

A successful innovation policy is therefore no trivial issue. Chapter 4 highlights the functioning of the capital market and the various public initiatives in the area. Chapter 5 deals with the provision of competence, and Chapter 6 discusses the formal and informal institutions required for innovation. Finally, the results and a number of policy conclusions are summarized in Chapter 7.

4. Financial Capital and Innovation

Access to financing and VC is a prerequisite for new knowledge to be commercialized. This applies in the early stages of development but is also important for innovations to be commercialized on a large, industrial scale. An important issue for business policy in general and for financing firms in particular is therefore whether the capital markets work well or not. In the latter case, the state may have an important part to play.

The capital market for innovative start-ups

The purpose of the capital market is to allocate capital from those with a surplus, savers, to those with needs, investors. It is fundamentally about managing risk, as all investments in a changing world are uncertain. This applies, in particular, to original business ideas.

There are several types of savers, ranging from private individuals and fund savers, or those with money on traditional bank accounts, to global actors such as insurance companies and investment banks. Financial markets enable companies that have good ideas for new products, services, or other solutions to obtain the financial resources needed. In return, those who provide the capital must be able to make a profit, for example through interest on a loan, by taking advantage of the profits if one is an owner, or through share dividends (Malkiel & Fama, 1970; Fama, 1991).

However, financing innovation is characterized by various types of information problems. The entrepreneur potentially has more information about their project than the financier,

which in turn makes it difficult to determine the quality of the project (Akerlof, 1970). It is also possible that the entrepreneur knows less about the project than they believe, as many entrepreneurs are overly self-confident (Koelinger et al., 2007). In addition, financing of innovation needs to solve what Cooter and Schäfer (2012) called the problem of “double trust,” where the financier wants insurance that they are not deceived, and the investment is sound, while the entrepreneur does not want to risk the innovation being stolen or copied by the financier.

Theoretically, the bank cannot solve this uncertainty solely by raising the interest rate to compensate for risk. A higher interest rate will lead to sound projects obtaining funding in other ways, which means that the bank will be left with poorer and poorer projects as interest rates increase. This in turn leads to most banks rationing credit by not granting risky loans (Stiglitz & Weiss, 1981).

If banks are able to provide risk-adjusted interest rates to borrowing companies, the problems are reduced, and it is even theoretically possible for all companies that need to borrow to do so (Arnold & Riley, 2009). Banks declining credit to some small companies are often criticized in the popular press or in entrepreneurship circles; however, from a societal perspective this also serves the purpose of preventing poor business plans from being funded, which in turn prevents unnecessary bankruptcies (De Meza & Southey, 1996). The market is a mechanism for allocation of limited resources. This means that *all* companies cannot and should not receive funding for *all* their ideas or projects.

The theoretical literature thus cannot in itself explain if information problems in the capital markets actually lead to market failures, but empirical studies are needed nevertheless. Studies of market failures in finance are however difficult to properly design and execute. In a sense, studying a market failure is about trying to investigate whether there are transactions that would have taken place if the market lacked information problems. It resembles how physicists observe black holes, that

is, not by studying them directly, which is impossible, but by observing effects in their surroundings.

To make the issue even more complicated, access to credit will vary over the business cycle (Becker & Ivashina, 2014). The financial crisis in 2008 marked a serious reduction in credit, which in turn affected companies' access to financing. Not least, the tightening of banks' lending as a result of the regulations in Basel III reduced the opportunities for bank financing of new innovations. For example, in Spain, which was severely affected by the crisis, this led to companies with limited access to credit being given preference for bank funding over other firms which may have shown more promise in the long term (Garicano & Steinwender, 2016).

In a review of the OECD (2006) before the financial crisis, the situation in the member countries was described as follows:

OECD countries do not report any generalized small and medium-sized enterprises (SME) financing gap. Most SMEs in OECD countries are able to obtain sufficient credit from banks and other credit institutions, supplemented in some cases by a modest volume of official guarantees.

The OECD (2006) report also shows that poor access to credit is an increasingly major problem in non-OECD countries with poorer functioning institutions and legal frameworks. Other research reaches the same conclusion (Aghion et al., 2007).

Several studies within Ratio's Financing of Innovation research program have looked at the Swedish capital market. Some of the initial studies indicated that small, new companies indeed have difficulties accessing both equity and debt markets. New companies often rely on their own savings, and bank loans are unusual. According to one study, 87 percent of a large sample of Swedish start-ups primarily made use of founders' own savings for setting up the firm (Bjuggren & Elmoznino Laufer, 2015). In this study, many respondents expressed their frustra-

tion with funding, even established SMEs. The results also show that many entrepreneurs have temporary jobs to finance their start-up companies, and that they occasionally avoid paying themselves a salary. The result can be interpreted as there being so much friction within the capital market that sometimes it is just easier to use one's own assets. The international literature also shows that established SMEs finance a lower proportion of their investments using external funding, particularly where bank funding is lacking (Beck et al. 2008). One policy conclusion of the above could be that it needs to become easier to accumulate private savings in Sweden (Wennberg & Laufer, 2014).

Distinct from *debt funding*, which largely comes from commercial banks or various types of governmental “soft loans,” there are several distinct sources of *equity funding* for innovative start-ups. Most central types of equity funding come from business angels, commercial VC and, more recently, various forms of government venture capital (GVC). Studies within the Financing of Innovation research program have shown how business angels and new forms of financing such as crowdfunding have in recent years gained a more prominent role as equity funders of new firms (Elmoznino Laufer et al., 2014; Elmoznino Laufer, 2016). Crowdfunding has received significant scholarly and public attention and, as a phenomenon, experienced rapid growth in Sweden as well as elsewhere (e.g. Sorenson et al., 2016). In Sweden, crowdfunding platforms struggled with some legitimacy problems, not least after a number of scandals that weakened trust in these platforms and spurred public discussions of new regulations (Elmoznino Laufer, 2017).

Business angel investment has been subject to significant stress in recent decades. Being early-stage investors, business angels tend to put great emphasis on the ideas and people they fund, often based on perceptions of trust and their own insight into the uniqueness of an entrepreneur or an idea (Mason, & Rogers, 1997). Since investments are entirely private, no public record exists of the total number of transactions made or

the financial sums (Avdeitchikova, 2009). As private investors often supplying smaller but important early-stage funding for start-ups, research shows that business angels take significantly greater risks than other investors. A 2004 study of 252 active Swedish business angels estimated median investments to be at around SEK 300,000 (in 2004 figures) but with significant variance. Compared to the 1990s, contemporary business angel investments are more often “syndicated,” that is, two or more business angels co-invest in specific companies. A more recent study of 193 Swedish business angels revealed that the majority were “highly aware” of potentially losing their money. Most of the angels surveyed invested smaller amounts: One in three had the capacity to invest over SEK 1 million per company (Elmozni-no Laufer et al., 2014).

VC has been noted to have several positive effects on the companies that receive it, even beyond the VC’s ability to efficiently screen and “select” fruitful investment companies (Croce et al., 2013). In addition to contributing capital, VC investments usually lead to increased competencies and improved governance of the companies that receive money. The potential downside of VC from the entrepreneurs’ perspective is that investors may gain control over firms, precisely in order to better manage them (Kaplan & Strömberg, 2001; Gompers & Lerner, 2001). Many entrepreneurs, however, are skeptical of external owners and oppose VC investments, even when they are offered more than the current company value (Bornhäll et al. 2016; Croce et al., 2019). This may seem irrational but is consistent with the broad literature showing that factors other than profit maximization drive entrepreneurs (e.g. Benz, 2009; Hurst & Pugsley, 2011). Long term, successful entrepreneurs may also seek to put their company on the stock exchange through an initial public offering and, in doing so, keep controlling rights of the company even as it grows (Wasserman, 2012). Private VC investments roughly amount to between 0.2 and 0.4 percent of GDP in the United States, Canada, and the United Kingdom (Avdeitchikova, 2008)

and in Sweden it has been estimated at 0.1 percent of GDP (SOU 2015: 64). To what extent these discrepancies across countries represent a tangible shortcoming for the financing of innovative new firms in Sweden, or elsewhere for that matter, is impossible to gauge. A potential shortcoming in the market for VC can be explained by many factors, such as national taxation rules, market accessibility, interest rates, etc., yet none of these reasons represents a “market failure.”

Governments can influence the financing of new firms in various ways, from designing the institutional framework in which investors and companies operate to direct investment in companies. Indirect strategies may, for example, be changes in legislation affecting private investors, tax relief for private VC investments, or support for business angel networks. Direct strategies mean that the state plays a more active role. The latter is often characterized as GVC, which generally can be divided into three groups: “investment guarantees,”³ “fund-in-funds,” or “direct investments.” The latter can take place through co-investments with private players or by means of the government investing on its own. Just as with private investors, government funders look for suitable investment objects, to support companies with various non-financial initiatives, and of course aim to achieve successful exits. However, the government has a broader goal structure than private investors, that is, to stimulate the country’s innovation capacity and contribute to regional growth. This approach is thought of as being “market-complementary” (i.e., based on a market failure logic). A common ambition with government investments is often to “signal” to private players that there are good opportunities for returns in segments in which private investors are not currently active. A common hope is that a GVC program would, in the long term, increase the amount of private VC investments

3) For example, the government could commit to covering a proportion of any losses that might be incurred by private VC actors.

in a country, which, given the positive effects that seem to exist from VC investments, could increase economic growth. However, academic studies have challenged the effectiveness of GVC (Brander et al., 2015; Cumming et al., 2017). A Canadian study showed that state intervention crowded out private capital to such an extent that the total amount of VC in Canada actually declined (Cumming & MacIntosh, 2006). A study using the VICO dataset on 8,370 European high-tech firms found that GVC investments themselves did not exhibit any positive long-term effects on sales growth among investees, but a positive effect when combined with private VC (Grilli & Murtinu, 2014). Similar findings were noted in Lerner's (1999) well-known evaluation of the largest GVC initiative in the United States – the Small Business Innovation Research Program (SBIR). Analyzing 1,135 firms, where approximately half of the sample received support from the SBIR program, Lerner found that firms which did receive grants grew faster in sales and employment over a 10-year period, but only among those firms located in areas with substantial early-stage financing from venture capitalists.

In a review of previous international studies on GVC's abilities to support young innovative firms, Colombo et al. (2016) highlight that GVC programs may have both “systemic effects” (such as nurturing the development of a private VC industry, with Israel being a common “success story”) and “treatment effects” by enhancing the productivity and viability of invested firms, measured as successful exit, innovation, and growth. However, they find mixed evidence for both types of effects. When GVC does seem to work it is when investments are made in tandem with private actors who may exert their “competent screening” by investing their own money, which the government investment vehicles obviously do not (Engberg et al., 2017; Grilli & Murtinu, 2014, 2015). However, a problem is that GVC tends to mimic private VC by investing more in established rather than new ventures, thus not contributing to solving the alleged market failure in early venture phases (Svensson, 2018).

Trying to study which companies have limited access to credit is difficult. In an article which attracted much attention, corporate cash flows were studied in relation to investments as a measure of credit limitation (Fazzari et al., 1988). However, the measure has been criticized and debated (Kaplan & Zingales, 1997; Fazzari et al., 2000; Kaplan & Zingales, 2000). Unfortunately, almost all external criteria on which companies are credit-restricted seem to be problematic and often unsuccessful at predicting behavior (Farre-Mensa & Ljungqvist, 2016). Since it is difficult to show which companies are genuinely affected, it is also therefore difficult to judge exactly how extensive the problem is.

In this context, it should be emphasized that there is a difference between a market failure and a financing gap. A financing gap means that companies operating at a suboptimal scale or capacity, and seeking to grow using outside capital, do not receive this capital despite having sound plans and finances, resulting in the company remaining at a suboptimal scale. The reason for this may be a market failure according to the above theory, but there may be more than information problems at play which could explain why a market does not work well. For example, this could be about taxes and rules that make it difficult to accumulate capital. The reason for the lack of capital in such cases is not a market failure but rather a policy failure. An improvement is then more easily achieved by changing the laws, rules, and taxes that affect the business enterprise. The Swedish government's official report outlining how Sweden can become more innovative (SOU 2015: 107m p. 211) states that the existence of a market failure is not sufficient to justify a public intervention:

Market failures are in practice difficult to observe and probably differ quite a lot between markets and industries, but above all between different types of research. The existence of market failures is also not a sufficient motive for why the public should intervene, especially when it comes to R&D and innovation activities in the companies. [Author's translation]

The effectiveness of government support schemes

Since the 1970s, governments around the globe have implemented policies to facilitate the funding of new innovative firms. These policies range from direct subsidies, tax cuts (directed especially at new or small businesses), special grants for working capital, business training, and counseling services (Rotger et al., 2012). Other policies seek to provide financial resources such as loans, R&D subsidies, or contracts through agencies or GVC funds (e.g., Brown & Earle, 2017). Through such policy interventions (also referred to as “input-related” policies), governments seek to provide support aimed at narrowing the knowledge and resource gaps entrepreneurs face as they launch and run their businesses. Implicit in these interventions is an effort to address presumed market failures for these entrepreneurs to close these knowledge and resource gaps themselves (Audretsch et al., 2007). Given the resources devoted to business support programs, it is natural to ask whether these interventions (“inputs”) are effective at growing successful ventures (“outputs”). Several studies offer widely different answers to this basic question (e.g. Amezcua, 2010; Autio & Rannikko, 2016; Grilli & Murtinu, 2014; Lerner, 2009).

To determine whether state and other public direct and indirect support schemes for companies are effective, careful empirical work is needed. However, carrying out empirical evaluations of selective support/subsidies is often a difficult challenge since these are unfortunately rarely distributed in such a way that they can be systematically evaluated. For example, in medicine it is common for studies to investigate whether a new medicine is better than its predecessor through randomized control trials. Since the group that has been given the new medicine is randomly selected from the total group of patients, there should be no systematic differences between the groups receiving the new and the old medicine, respectively. It is thus easy to compare the effect between groups, and if there are any differences they will only depend on which medicine the patient received.

Unfortunately, it is still unusual for economic policy initiatives to be designed and evaluated the same way, although it has become more common, especially in the United States. A common practice in many government support schemes is still to distribute funds to the companies that actively seek and qualify for such support. Such companies differ from other companies in several ways: They can be more successful than other companies, as they passed an evaluation to receive their support, or they may be less profitable than other companies, as they needed to apply for public support. This makes it difficult to study the effect of support schemes. If these firms do better (or worse) than the average company in Sweden, is it because of the aid or because these companies were different to begin with? This is a problem referred to in the econometric literature as “selection bias,” that is, since the companies themselves have chosen to seek support, they are probably different from the average (Angrist & Pischke, 2009).

Trying to deal with selection bias is one of the greatest challenges in empirical social science, and over the past 30 years a variety of methods have been developed to address the issue (Angrist & Pischke, 2010). Unfortunately, these methods demand carefully designed studies using detailed data, which often hinders systematic evaluation.

Another problem for government efforts is to prevent their interventions from *crowding out* the availability of resources already provided by market mechanisms (e.g. Cumming et al., 2018). For example, if authorities offer lenient loans, support, or other measures on more favorable terms than the private sector, there is a risk that companies simply replace private money with public money without a net increase in the amount of capital. Instead of crowding out, the goal is to achieve *additionality*, that is, that the public effort adds productive value over and above that already existing, not only for an individual firm but for the economy as a whole. In order to achieve high additionality, public money should ideally be invested in companies and projects

that are sufficiently profitable that they will succeed in the market, but not so profitable that they could receive private funding.

Given these evaluation problems, it is not surprising that the empirical results around active measures to increase the amount of innovation within companies, or otherwise to strengthen (especially) SMEs, diverge. Hence, there is a great need for studies that try, as far as possible, to deal with the problems related to selection bias (Klette et al., 2000). There is also widespread disagreement in the existing research, where some researchers are positive about government initiatives (Mazzucato, 2015) while others are more skeptical (Lerner, 2009). At the same time, there are strong reasons for increasing the amount of R&D, and the efficiency of the R&D being implemented, as several studies indicate that it has become more difficult to find new breakthroughs, which will reduce long-term economic growth (Erixon & Weigel, 2016; Gordon, 2016; Bloom et al., 2017).

The international experience of R&D support is extensive, but highly mixed. A study on Israeli innovation support found positive effects on small businesses, but negative if the aid was given to large companies (Lach, 2002). A German study indicated that support did increase private companies' R&D investments (Hussinger, 2008). A study on US R&D support for small businesses found that support primarily crowded out private money and did not produce any positive effects (Wallsten, 2000). Recent research has however found positive effects of innovation subsidies on innovation in the US energy sector (Howell, 2017). Overall, results seem to differ depending on the method used, the sector and region that is subsidized, and how the subsidies are distributed (Colombo et al., 2011).

A literature review summarizing 77 different studies of government support schemes produced unclear results and had methodological problems, mainly related to companies that benefit from multiple supporting activities (Zúñiga-Vicente et al., 2014). Evaluating efforts where companies receive more than one type of support is methodologically complicated and there

are few developed econometric methods to solve the problem. When firms have received several support initiatives, it becomes difficult to distinguish which of the supports had a possible effect or if the effect arose cumulatively. One of the countries with the longest history of offering a range of policies in support of entrepreneurship is the United Kingdom. In a long-term study of various UK government initiatives to support new and small firms, Bennett (2008) surveyed more than 2,000 firms in 1991, 1997, 2002, and 2004, finding that, overall, government intervention is difficult to make effective at reasonable cost-benefit ratios. Bennett finds little evidence of market failure for growing and more innovative firms, but rather than systemic market failures in the United Kingdom only seems to influence very early-stage start-ups. Over the study period, the UK government partly decentralized previously centralized programs, which had marginal benefits for the number and type of recipient companies on the one hand, but sharply increased public costs and the bureaucracy recipient companies had to negotiate on the other. Bennett's survey also highlights the stark gender bias in a highly disproportionate number and sum of support provided to male-led firms, compared to the average level of male- and female-led small and new companies.

Not surprisingly, the Swedish experience also shows mixed evidence. Norrman and Bager-Sjögren (2010) examined the Swedish Innovation Center's EUR 56 million initiative to support "innovators in their absolute earliest phases of development with financial capital, advice and networks" between 1994 and 2003. The support came in two forms: (1) an "innovation subsidy" of approximately EUR 4,000, distributed to all participating companies, and (2) a conditional loan of a maximum of EUR 43,500, which only had to be repaid if the project generated revenue. Using a comparative sample of applicant firms that either received or did not receive the support, they found the impact of the program to be "weak or non-existent." They also found that the projects that program officials considered to

be “the most promising” did not perform any better during the six years following the support than other firms, leading Norrman and Bager-Sjögren (2010, p.615) to conclude that “given eligible applications, supported firms could just as well be picked randomly.” One more recent study using a similar design as Norrman and Bager-Sjögren’s, where rejected and accepted applicants are compared, found positive effects of Vinnova’s innovation support program (Söderblom et al., 2015). Other contemporary studies concerning Vinnova’s research schemes “Forska & Väx” and “Vinn Nu” found negative effects instead (Daunfeldt et al., 2014). A closer look at the regional variation of these schemes showed that they had some positive effect in large cities, but the average effect became non-existent because the effect was significantly negative in sparsely populated areas (Tingvall & Videnord, 2018). The same was true in a more comprehensive study of all support from Vinnova, the Swedish Agency for Economic and Regional Growth, and the Swedish Energy Agency: short-term effects but no long-term ones (Gustafsson et al., 2016). A common issue among these programs, from the 1990s until today, is that evaluations had to take place post hoc using available data, even though program evaluation is already suggested to be an integral part of the program planning and initiation steps. No medical authority or clinical doctor would prescribe a medicine that has not been randomly tested in several independent studies. When it comes to (rather expensive) innovation support, however, such care in design and evaluation of various interventions is still lacking in Sweden, despite tools and structures being readily available and often mandatory in other countries such as France, the United Kingdom, and the United States.

Policies enacted are also highly heterogenous. Some government support comes in the form of free or subsidized advisory services, rather than as financial support. A recent study by Widerstedt and Månsson (2015) examined the effect of business counseling support from a 2004–2007 Swedish grant program,

aimed at companies in peripheral regions, in which 1,244 firms that applied for and received advice were compared to more than 90,000 control group firms in a matched sample. The authors found that while value added and number of employees seemed to increase more rapidly for firms that received advice compared to the control group, this effect was mainly due to increased use of labor and capital rather than increased efficiency, and the differences disappeared when self-selection of companies seeking advice was controlled for.

Other government support comes in the form of subsidized or wholly funded incubators and science parks, where companies can apply for subsidized facilities, business advice, networking support, etc. What makes such incubators more (or less) successful has been amply studied in the innovation literature (e.g. Bruneel et al., 2012; Phan et al., 2005). However, studies that identify whether incubation is actually, on average, advantageous for beneficiaries and a cost-effective way for society as a whole to foster the creation of new innovative firms are scarce. Recent evidence from the United States, Italy, and Germany suggest that incubators are very heterogeneous and that, on average, incubated firms perform no better than comparable non-incubated firms when their support comes to an end (e.g. Amezcua, 2010; Lukes et al., 2019; Schwartz, 2013). In Sweden, arguably the first study to examine this issue was McShane's (2017) investigation of the performance of information and communications technology-incubated firms in south Swedish Malmö (Minc) and Lund (Ideon Innovation), where firms were observed before, during, and after the incubation period. McShane found that return on capital and sales actually dropped during incubation and continued to be significantly lower afterwards, compared to a matched sample of non-incubated firms. The employment levels and overall asset base of the incubated companies were however not significantly affected. In a comprehensive study of "the Swedish incubator program" – a governmental program overseeing the overall financial support

and management of more than 40 incubators across Sweden – Ejerme (2018) studied both how incubation affects performance of participating firms as well as innovativeness in terms of patenting among individuals managing or employed in these firms. Comparing 296 CEOs and 2,585 employees in incubated firms with a matched sample of comparable individuals in similar (non-incubated) firms in 2005–2014, he found that while incubation did not foster economic performance measured as growth in turnover or value added among participating firms, incubation did seem to foster innovativeness in the form of patenting activity among CEOs of incubated firms. For employees, there was only a small effect on increased patenting. In all of the aforementioned studies, men predominate as founders, CEOs, and employees of new firms, and male-led firms are much more likely to be found in public incubators around Sweden. The male/female gender ratio is often as skewed as 80/20 or even 90/10, despite more than 30 percent of all new firms being founded by women. These discrepancies may be explained by gender bias in assessment of men and women seeking public support for their businesses (Malmström et al., 2017).

Furthermore, it appears that the support schemes can generate strange behavior in companies. Since there are several authorities that distribute support, and because there is little coordination between the authorities from which companies receive money, some companies systematically seek and obtain several grants for related purposes, in a sense becoming “subsidy entrepreneurs” with lower long-term productivity but being able to hire skilled workers and pay them well (Gustafsson, Tingvall, & Halvarsson 2018). It is unclear what effects this will have for society at large, but it would be problematic if the grants designed to stimulate innovation instead led to some companies simply specializing in getting grants.

According to *Growth Analysis* (Gustavsson et al., 2015), total support for the business sector in 2011 amounted to just over SEK 27 billion, or more than 3 percent of the Swedish govern-

ment budget.⁴ In light of the fact that clear positive effects have thus far proved hard to identify, there are reasons to question whether this is an effective use of tax funds. Lerner (2009, p.5) summarized extant evidence on government interventions for innovation as: “for each effective government intervention, there have been dozens, even hundreds, of failures, where substantial public expenditures bore no fruit.” In their article “Public policy to promote entrepreneurship: A call to arms,” Acs and colleagues (2016) similarly note:

Reviewing established evidence, we find that most Western world policies do not greatly reduce or solve any market failures but instead waste taxpayers’ money, encourage those already intent on becoming entrepreneurs, and mostly generate one–employee businesses with low–growth intentions and a lack of interest in innovating. Most policy initiatives that would have the effect of promoting valuable entrepreneurship would not be recognizable as such, because they would primarily address other market failures: A central–payer health care [system] would remove healthcare related distortions affecting employment choices; greater STEM education would produce more engineers of which some start valuable new firms; and labor market reform to encourage hiring immigrants in jobs they have been educated for would reduce inefficient allocation of talent to entrepreneurship.

4) Support that is not classified as directly targeted at business and which is therefore not included in the above–mentioned SEK 27 billion includes: EU Structural Funds; agricultural policy support; certain aid programs with lesser amounts; support of a cultural policy nature; procurement of traffic made by Rikstrafiken (the Swedish Transport Administration); The Swedish Civil Aviation Authority’s (Transport Administration) support to private airports; labor market policy programs that promote employment rates via unemployment insurance funds (including labor market support for companies); subsidized information services; administrative costs for operating support organizations; housing subsidies; and support paid to the public sector (Gustavsson et al., 2015).

Government loans for innovation

Another form of government support for companies is loan guarantees or soft loans. The goal is to increase the total amount of bank loans in the economy and, in particular, for SMEs who may find it difficult to get bank loans without help. Banks have relatively high fixed costs for reviewing a company, set-up fees, and so on. As banks make money on the interest of a loan, all else being equal, larger bank loans become more profitable than smaller ones. Smaller companies also lack assets that can be used as collateral for their loans, increasing the banks' risk. In theory, the banks could compensate for this increased risk by increasing interest rates, but for several reasons the banks prefer to ration credit by denying risky companies access to loans (Stiglitz & Weiss, 1981). Moreover, new and young companies lack long credit histories that show whether they have dealt carefully with previous loans and used the money for productive investments, which increases the banks' uncertainty and, thus, risk and makes them reluctant to grant loans to younger companies (Akerlof, 1970).

All in all, there are several reasons why market equilibrium in the banking sector can mean less bank lending to companies than would be optimal for the economy. For these very reasons, there are different systems in many OECD countries where the state either guarantees private bank loans or lends itself directly. The theory behind credit guarantees is that if the state guarantees a large part of a possible loss when a company goes bankrupt, or otherwise cannot pay its bank loan, risk for the private bank decreases and banks are thus more willing to lend to companies that otherwise would not receive a loan. While some studies from the United States show that these credit guarantees lead to more bank loans and that firms receiving these loans tend to employ more people (e.g. Brown & Earle, 2017), such effects likely also come at a cost. For example, de Andrade and Lucas (2009) analyzed loans from small firms in the United States sponsored by the Small Business Administration, finding that between 1998 and 2006 such loans were, on average, 2

percent over the prime lending rate, and for smaller (Express) loans between 2.5 and 4 percent over. Their analysis suggests that default rates or other potential costs do not justify such significantly higher interest rates. This example highlights the risk that well-intentioned efforts to stimulate lending to underserved small business borrowers may create information monopolies for large banks to earn supernormal rents on the loans they extend to borrowers that would otherwise be screened out from the market (Acs, et al., 2016). Also, it has been noted that the risk of default often increases for SMEs relying on publicly guaranteed debt (Lelarge et al., 2010).

In Sweden, public loans are transferred directly to companies by the state-owned company Almi. Almi often, but not necessarily, works in collaboration with private banks. The most common way is that companies borrowing from Almi also have a private bank loan, usually amounting to 50 percent of the loan. Almi charges interest rates to compensate for its high risk, which reduces the risk of loans being overused. An evaluation of Almi's loans shows that, on average, they do lead to increased productivity and sales in the beneficiaries, but that employment growth is limited to firms located in urban areas (Gustafsson, 2018; Gustafsson & Stephan, 2019). The fact that the subsidy loans have different effects in Sweden compared to the United States can either be due to the different design (the size of the loans is generally larger in the United States and loans are issued by a commercial bank with the federal government as guarantor) but can also be due to differences in the financial infrastructure and labor market settings, in particular the lack of available personnel in non-urban Swedish areas. This highlights that a shortage of competent labor may be a more acute impediment to growth than credit constraints for new firms, which we discuss next.

Is financing a major problem for innovation?

As we have established, there are theoretical arguments for potential governmental interventions conceived to increase access

to capital in, above all, research-intensive and young SMEs. Such arguments have led governments around the world to adopt measures such as GVC, subsidized loans, credit guarantees, R&D tax credits, and direct financial injections, with hopes to increase the amount of innovation and employment growth in the economy.

Empirically, however, it is doubtful whether such support initiatives work as intended. In the same way as it is difficult for the market to know which companies should receive money, it is equally difficult for government officials to make such an assessment. The presumed existence of a market failure is a necessary but insufficient criterion for public intervention. The criterion is insufficient because the government's ability to solve market failures presupposes the absence of policy failures, caused by both administrative costs and information problems and risks of distorted incentives.

Government interventions also run the risk of experiencing other political problems. In Germany, it has been found that soft loans have not necessarily gone to companies that needed them most but to companies where the management had personal connections to the state banks (Haselmann et al., 2018).

Another conclusion is that state aids of this kind, in so far as they should exist, should be designed in such a way that they are easy to evaluate. One possibility would be to design innovation support so that companies applying for it undergo a first screening, and among those that are selected as eligible, distribution of the grants is randomized for a portion of firms so that the effect of the support can be compared with those that were also deemed eligible but did not "win" the support. In this way, an appropriate control group is created for the companies that receive support and, after a few years, it will be possible to see if the support received had the intended effect. Evaluating the effect would then be considerably simpler and, long term, it would be possible to design the support in such a way that it had the greatest effect. The risk of not distributing support in a way that

makes it easy to evaluate is partly that it wastes public funds and partly that the amount of innovation or growth generated is not maximized.

The above results also indicate that capital supply does not seem to be the main problem for innovation and for nursing more fast-growing firms in an economy. In the vast majority of cases, the capital markets function well and are the most suitable option for managing the risk posed by financing innovation. Competent capital – defined as well-informed investors who directly or indirectly take personal risk on their investments – usually comes in the form of capital that has been generated and reinvested by private actors with little public interference (Eliasson, 2000; Sjögren & Zackrisson, 2005).

In practice, it is also difficult to prove the existence of market failures or financing gaps. Although some companies are disappointed that they do not receive funding, this cannot be taken as proof that there is a structural problem requiring a correction. Our results also show that public interventions are associated with several challenges and that positive effects are often lacking, or in any case difficult to prove. These results are in line with previous reviews and conclusions in the field (Svensson, 2018; 2011). An innovation policy for growth thus needs to have a different focus than tinkering with various support programs if it is to make a significant difference.

5. Competencies and Innovation

Several studies within the Financing of Innovation research program emphasize that competence shortage is a greater problem for growing firms than lack of capital. For innovation, human capital, or competent employees, is particularly important. In particular, radically new innovations often have entirely new requirements for competencies.

Competence, innovation, and growth

In a modern economy, the prerequisites for starting, running, and expanding companies rely on the availability of competent employees (Colombo & Grilli, 2005). In economic research and debate, the crucial role that investments in competence (here most commonly called human capital) have had for economic development has been increasingly emphasized over the past 50 years. The importance of human capital was first formalized by Becker (1964) and has since gradually developed into a central explanation model for innovation and economic development in individual countries over time, as well as for why development and prosperity differ among countries.

Human capital increases productivity in physical capital. A trained workforce benefits from advanced production technology. Countries with good access to human capital have a greater ability than countries with a less educated labor force to assimilate technology developed elsewhere (Lucas, 1988). Unlike physical capital, human capital does not have diminishing productivity (Romer, 1986; Mankiw et al., 1992). Human capital has a positive external effect. An individual's productivity increas-

es if they collaborate with individuals who posit strong human capital (Lucas, 1990). Human capital is also an important source for innovation, which means that the knowledge of separate individuals can be widely used and becomes a basis for further human capital development and new innovation, thus generating robust economic growth in the long run.

There are therefore strong theoretical foundations for the idea that long-term success of a country's innovative capacity rests in its population's education and skills. Without a well-educated and trained workforce, entrepreneurial endeavors are less likely to reach their full potential and innovations are less likely to be realized and spread (see e.g. Gennaioli et al., 2013 for stylized cross-country evidence). A well-founded national innovation policy thus needs to have a base that prioritizes investment in education and skills in order to strengthen a country's long-term competitiveness.

A shortage of competence

Despite the fact that Sweden has invested ever greater resources in schools and higher education for decades, competence shortages prevail in most sectors of the economy.

Several studies, national as well as international, claim that the supply of competence in Sweden is suboptimal for a modern economy (Karlson et al., 2017). For example, the World Bank's 2014 report on the Swedish business climate highlighted a lack of human capital as the biggest obstacle to continued growth. Particularly noticeable were the problems in the metal and engineering industries, where there were few employees with relevant professional skills (World Bank, 2014). The Confederation of Swedish Enterprise is continuously investigating companies' recruitment needs and its report from 2016 showed that not only heavy industry but also growth sectors such as IT and telecom had significant recruitment problems. Of the IT and telecom companies approached, 41 percent stated that they had cancelled planned expansions due to recruitment problems that

were either related to lack of professional experience or the right education (The Confederation of Swedish Enterprise, 2016). In the Swedish Agency for Economic and Regional Growth's 2014 survey, similar conclusions were drawn, and it was found that recruitment problems are particularly pressing for companies with between 10 and 49 employees.

The match between labor market supply and demand has worsened for several years (Karlson & Skånberg, 2012; OECD, 2016). Only 40 percent of the Swedish workforce is 'matched' in the sense that employees have a job that corresponds to their educational competence (Le Grand et al., 2013). Just over 50 percent are overeducated and just under 10 percent are undereducated. At the beginning of the 1980s the proportion of overeducated people was around 20 percent, indicating an increase over a longer period.

Competence shortfalls and difficulties in finding a good match between job demands and available staff are, if anything, more severe in new and small firms than in incumbents. Research on small firms indicate that these seem to use more diverse human resource practices in their work on recruitment and competence issues (Wennberg et al., 2013). However, they do not always have the most sophisticated or modern human resource practices due to lack of time and sufficient knowledge in the field (Pearson et al. 2006, Hornsby & Kuratko 1990). Specifically, rapidly growing firms often report problems in recruiting new employees (Tansky & Heneman, 2003). In the United States, this tends to depend, for instance, on the cost of employee health insurance. In Sweden, other factors have been suggested to impede the recruitment of competent staff in growing firms, such as lack of recruitment channels and brand awareness among potential employees. In addition, there are institutional constraints such as labor market legislation, centralized wage formation, and difficulties in offering sufficiently attractive options and bonus systems for growth companies (Henrekson, 2001). One study specifically attends on recruitment patterns

and challenges for growing firms. Wennberg and colleagues' (2003) study of recruitment patterns and challenges for growing firms examined a random sample of 126 rapidly growing firms in Sweden, defined as those with 20 percent annual growth over a three-year period, positive operating profit, and at least SEK 10 million in sales at the beginning of the research period. Results indicate that informal recruitment channels, such as the family or business network of the entrepreneurs, are common recruitment channels for these companies. For larger firms, the recruiting process tends to be more formalized and involve recruitment agencies or job centers, for example. For getting a job in a rapid-growth firm, social competencies appear more important than formal merits, the most important criterion being to "fit in" with the company's culture, work ethic, etc. A majority of the companies surveyed emphasized lack of relevant competencies as one of the most prominent obstacles to growth.

There are several reasons for this lack of competencies. In Ratio's earlier Competence for Growth research program, results stated that competencies can be enhanced by addressing four different components, namely: 1) the quality, efficiency, and relevance of education; 2) employers' involvement and participation in education design and implementation; 3) addressing rigidities in the overall labor market functionality; and 4) updating of skills and continued learning (Ellström, 1998; Karlsson et al., 2017).

Put differently, theoretical education alone is not enough; in most contexts, practical experience and critical reflection on the experience gained is also required to truly acquire competence. Competence is not static but needs to be continuously developed and adapted to new conditions and needs (Ellström, 1998). The quality and efficiency of education is therefore fundamental to an individual's competence and continued development.

However, lack of competence and matching problems cannot be solved solely by committing more resources to the education system. Instead, the *relevance* of the education curriculum for

the workplaces of today needs to be stressed. This necessitates employers' involvement and participation in the design and implementation of both vocational and higher education. As many evaluations have shown, the steering and resource distribution systems of public higher education needs to be reformed to focus on quality of skills acquired rather than number of students taught (e.g. Alvesson, 2006; Fransson & Jonnergård, 2009, p.58). Workplace-based learning is necessary to develop practical skills and abilities (e.g. Smith, 2003).

Relatedly, a well-functioning labor market where wage formation, regulatory systems, and employment services stimulate career development and matching of skills with demand for labor is necessary if individuals, companies, and society are all to benefit from investment in knowledge and skills development. Moreover, increased labor market flexibility is needed to reduce mismatches among employees in the workplace. Strict employment protection contributes to increased risk in new recruits, low staff turnover, and lock-in effects, as well as reduced productivity.

The challenge of digitalization and a rapidly changing world means that updating of competence and continued learning through life is crucial for the provision of competencies, innovation and sustainability. This applies to individuals, companies, and society as a whole. Education needs to be made available to employees who need to broaden and deepen their skills to a greater extent.

Consequences of the competence shortage

The competence shortage affects the ability of both large and small companies to grow and innovate. As previously shown, large companies play an important role in the innovation process: They perform significant R&D and are also responsible for a significant share of innovation in the Swedish economy. Established companies possess the financial muscle sometimes required to carry out extensive development work, and several

of Sweden's foremost innovations in modern times have come from larger companies. These companies also have an established relationship with the market, which sometimes makes it easier to develop new ideas.

However, it is clear that significant technological changes also entail extensive needs for new skills. One important factor in the collapse of the mechanical calculator manufacturer Facit in the early 1970s was that the company's fine mechanical know-how gradually became useless with the shift to electronic calculators. There was little expertise in electronics in Sweden at the time and Facit had difficulty recruiting and mobilizing a critical mass of engineers to the remote company headquarters of Åtvidaberg (Sandström, 2013). The example may seem old and partially outdated, but the fact is that many companies have faced similar challenges in the more contemporary transition to digital technology.

Several studies within Financing of Innovation have demonstrated the critical role of competencies for established companies' ability to handle digitalization. The digitalization of financial markets picked up in Sweden in the late 1980s. When the Stockholm Stock Exchange changed technology from electromechanics to electronics, the IT department grew steadily for several years despite the fact that the number of employees decreased overall (Ernkvist, 2015; Cheung et al., 2017). The Swedish telecommunications monopoly Televerket also faced extensive renewal of its competencies with the growth of mobile telephony and the transition to fully electronic switches (Geissinger et al., 2018). More contemporary empirical studies also show the need for new competencies to successfully handle digitalization. For example, when the hearing-aid industry switched to 3D printing of earbuds in the early 2000s, the need for new competencies was the single greatest challenge for these companies (Sandström, 2016).

New companies are often promoted as winners in technology transitions and there are studies showing that these companies

have a crucial role when new technology is introduced. Furthermore, they are of central importance to the Swedish economy because the majority of all new jobs are created in fast-growing companies, also called gazelles. Against this background, it is important to understand the growth obstacles these companies face. Here too, a lack of competent employees is one of the main obstacles for fast-growing companies to be able to grow (Demir et al., 2016).

As emphasized above, technology shifts often mean that new competencies and a new business logic are introduced in a mature industry. If large Swedish companies have to cope with these changes, new skills are needed, but fast-growing small and medium-sized enterprises (SMEs) also need access to new competencies to exploit the opportunities that the technology creates. In a study of how Swedish Axis pursued the shift from analogue CCTV cameras to digital, internet-based cameras, it was shown how its experience in IT made it possible for the company to introduce an IT-based logic in a traditional industry. The competence base and the sales model changed with Axis' entry into the industry, which meant that the company could leapfrog established players (Berglund & Sandström, 2017).

Clarifying the societal role of universities

As more and more people have realized the value of innovation and entrepreneurship, the role of universities has also changed. Universities have been given a broader responsibility. Traditional tasks in the form of research and education have been supplemented with the so-called "third task" which, simply put, is about communicating the results of the research. At the same time, universities have received an extended assignment to "play their role" in an often top-down orchestrated "innovation process" (Etzkowitz, 2003). Not infrequently, inspiration comes from the academic work on innovation systems and the related notion of Triple Helix, where collaboration between universities, authorities, and companies is considered the pre-

requisite for innovation, but few evaluations of any tangible results gained from this broadening of university tasks are ever conducted.

Many higher education institutions now generally have some form of incubator, a Technology Transfer Office (TTO), or a science park. Often there is also a regional perspective, based on the literature on localized knowledge spillovers (Audretsch & Feldman, 2005), where the idea is that investment in utilization of research will lead to growth and more innovation at a regional level.

However, growing evidence indicates that public decision makers have been overconfident in the universities' ability to cope with a broader role in the innovation process. As previously stated, a relatively small proportion of the innovations arise at universities, that is, only about 3–7 percent (Bourellos, 2013; Henderson et al., 1998). Indeed, in most sectors such as engineering, IT, and telecom, the proportion of innovations that come from universities is almost negligible. However, in areas such as chemistry, biochemistry, and medicine, universities seem to play a more important role (Block & Keller, 2007).

An important reason for this is that research and innovation are two related but different phenomena. In simple terms, research is about developing new knowledge and using systematic, scientific methods that place demands on replicability, transparency, and validity. Good research is carefully executed, producing new knowledge. Knowledge development is usually a cumulative process in which each individual researcher can only contribute a small part. Research thus is, by its nature, often particular rather than integrative and holistic, the researcher's skills being related mainly to generating new knowledge within a narrow scientific domain.

Innovation and attempts at commercialization of knowledge through entrepreneurship require a different collection of skills. This knowledge tends to originate in firms, their competitors, and research departments at universities and colleges at home and abroad. The entrepreneur or the innovator is not primarily

interested in new scientific knowledge per se but the spread of something new with its associated rewards. Innovators and entrepreneurs are therefore often generalists rather than specialists; they are looking for business opportunities and are rarely interested in whether something constitutes a scientific discovery or not. These underlying priorities and incentives are likely the roots of empirical findings that show that companies created by researchers generally perform worse than companies started as spin-offs from large companies (Wennberg et al., 2011).

Although the above is of course a simplification, the differences between research, innovation, and entrepreneurship mean that universities are rarely suitable for generating innovation. Government- and university-specific initiatives to make universities more innovative therefore risk having limited effects.

In a systematic review of the literature on research on academic entrepreneurship, Sandström et al. (2016) show that universities trying to commercialize research face significant challenges. The researchers go through 176 of the most cited articles in the field and find that 49 percent of them report different forms of structural challenges. A significant proportion of these show that the incentive structures of academia are rarely compatible with commercialization processes. Researchers usually have limited financial incentives to engage in entrepreneurship, and they rarely receive peer recognition for doing so. As a result, most researchers seem to prefer secure employment at the university over entrepreneurship (Rasmussen & Borch, 2010). Furthermore, it is clear that researchers rarely possess the skills and social capital needed to commercialize research (Vohora et al., 2004).

A variety of contextual factors determine whether or not universities are capable of creating and spreading innovations. Specifically, institutional factors and the regional environment of the university appear to strongly affect the outcome. Silicon Valley, which has served as a model for the rest of the world, is a good example. Lots of attempts to copy Silicon Valley and its interaction with Stanford University have been made (Brauner-

hjelms, 2007). The problem, however, is that the vast majority of countries and regions do not have the prerequisites for capital, competencies, and institutions located at Stanford and in Silicon Valley. Competent VC and an entrepreneurial culture are of course important ingredients, but it is the interaction between these qualities and the knowledge environment of Stanford that together attract talent, which further reinforces the positive feedback loop (Saxenian, 2007).

Historical research on Silicon Valley has shown that the region's prospects of becoming a successful cluster can be traced at least back to the beginning of the 20th century. From the 1920s onwards, production of vacuum tubes evolved in the region, which required sophisticated and clean manufacturing processes. Based on these competencies, among other things, it was natural that Silicon Valley became a leader in the manufacture of semiconductors during the 1960s and 1970s, which later paved the way for software development. The emergence of clusters, with related competencies, institutions, and universities is usually an evolutionary and unpredictable process (Lecuyer, 2006). Such organic development is thus much better suited to the type of innovation system that has been called "National Systems of Entrepreneurship," where innovations emerge "bottom-up" through entrepreneurial competition within an appropriate institutional framework.

The university's main role in innovation systems seems to be to conduct excellent basic and applied research combined with high-quality and relevant business education. The latter should not be underestimated: For example, students at MIT and Chalmers have been shown to start both more and better companies than the researchers within university faculty (Astebro et al., 2012). Research on academic entrepreneurship, incubators, and science parks suggests that such initiatives only have limited effects. Investments in education that promote student entrepreneurship are likely to have greater positive effects (Astebro et al., 2012; Wennberg et al., 2011).

Given the opportunity costs, it therefore seems logical that, rather than increasing the emphasis on their own commercialization of research results, universities should prioritize fulfillment of their core tasks: research and education. However, closer cooperation between the universities and the business community is needed, preferably pure co-production and commissioned research, and increased personnel mobility (e.g., through industrial doctoral students). Universities also need to increase the relevance of their educational programs and offer more opportunities for internships.

6. Institutions and Innovation

Entrepreneurship and innovation require that the institutions of society in terms of laws, rules, and values – what researchers call institutions – enable and provide incentives for the commercialization of new productive knowledge in a broad sense. The conditions must be effective not only for entrepreneurs but also for complementary actors such as venture capitalists, industrialists, workers with adequate education and work experience, and customers. A system in which innovation mainly emerges through entrepreneurial competition in markets requires an appropriate institutional framework.

The critical importance of institutions

In economics as well as political science, sociology, and business economics, research on institutions has grown in recent decades. Institutions usually include, according to current definitions, the laws, rules, values, and norms that structure human actions and interactions (North, 1990). Institutions may be formal in legal terms but may also be informal as with cultural norms.

Fundamental to the market economy and, hence, the innovation system is private ownership and the contractual freedom related to it. What distinguishes a market is voluntary agreements within the framework of a system of private ownership. Other distinctive features of market economies, such as companies, marketplaces, profits, growth, innovation, competition, bankruptcies, and so on, follow as a consequence of ownership (Cooter, 2000). This means that the rule of law and impartial application of rules are of central importance. Of course, a func-

tioning education system and effective taxation are crucial to creating an entrepreneurial and innovative economy. Taxes, as well as how laws and regulations are crafted and implemented, are often highlighted by entrepreneurs as significant challenges to growth. Issues related to employment and labor market regulations also seem to be particularly important growth barriers (Lougui & Nyström, 2014).

In a 2016 study, Ratio compared nine different indices that compile countries' competitiveness, regulatory burden, economic freedom, entrepreneurship, and innovation ability to assess Sweden's international position in these areas and how business conditions have evolved in recent years. All selected indices are regularly recognized in the press and often form the basis for government policy recommendations. Several of the indices are frequently used in research (Karlson & Larsson, 2016). The comparison shows that Sweden was ranked among the top 10 in several indices. In the area of innovation, for instance, Sweden is one of the foremost countries. However, its position in relation to important competitor countries has deteriorated in recent rankings. Several indices highlight that high taxes, centralized wage formation, and rigid employment regulations are the areas with the greatest potential for improvement in Sweden.

Taxation on entrepreneurship and individuals is an area in which Sweden stands out. For example, according to the World Economic Forum (2015), Sweden is ranked 94th in the sub-component "effect of tax on the incentives to work" and 112th in the sub-component "total tax burden." A similar pattern is found in the index of economic freedom. In the 2015 ranking, Sweden ranks 156th in the category "public sector size," a clear deterioration from 141st in 2010 (Fraser Institute, 2015). A number of individual taxes as well as the total tax burden are also on the rise.

When it comes to the labor market, Sweden occupies 106th place in the sub-category "employment and resignation regulations" and 133rd in the sub-component "flexibility in wage

formation” (World Economic Forum, 2015). The World Bank has also pointed out that the labor market is an area in which Sweden has great potential for improvement. In 2010 Sweden ranked 117th in the category “employing workers,” however this category was excluded from the index in the 2011 report, which partly explains Sweden’s positive change in overall ranking from 2010 to 2011 (World Bank, 2009; Karlson & Larsson, 2016).

Ratio supplemented this index analysis with country studies from the OECD, the World Bank, Swedish authorities, and organization reports, as well as interviews with business executives and representatives of industry and employer associations that, together, represent tens of thousands of Swedish companies (Karlson & Larsson, 2016). The overall conclusion was that the most potential for improvement is in the following areas:

1. Skills and competencies
2. Flexibility of the labor market
3. Taxes on entrepreneurship and individuals
4. Administrative efficiency and regulatory burden
5. Public procurement
6. Housing and infrastructure
7. The role of private enterprise in society

The lack of competence and the shortcomings in the labor market’s flexibility have already been discussed in the previous chapter. Swedish taxation on labor, consumption, and capital is, with some exceptions, also far above the levels that apply in comparable countries. This creates tax incentive problems and a number of distortions with strong negative effects on opportunities to start, operate, and expand businesses.

Deficiencies in administrative efficiency and regulatory burden, according to the companies themselves, is one of the areas that creates the biggest problems in that it increases costs and is more expensive for smaller firms to follow rules than for larger companies. Sweden also has one of the most centralized

procurement systems in Europe, with a development toward centralized acquisitions and agreements, where large companies benefit. The housing shortage, but also an underfunded infrastructure and uncertain energy supply, mean that companies cannot recruit the personnel they need, especially those coming from abroad or moving within Sweden.

Shortcomings in the wider perception of entrepreneurship and private enterprise in society are also highlighted as an area for improvement. This is partly about the lack of understanding among municipal officials and politicians concerning the needs and realities of companies, not least with regard to permits and application of rules, and partly about the negative attitudes of politicians and government representatives to competition and profits in important service markets. Below, we delve deeper into some of these areas.

A growing regulatory burden

Shortcomings in the exercise of authority, the regulatory burden, and the application of rules apply to both Swedish rules and EU rules. Environmental permits such as building permits, licensing permits, and various other forms of licensing often take a long time to process, and processing times also differ across local areas. Moreover, a recent study shows that costs associated with rules and permits are disproportionately higher for smaller companies (Karlson & Larsson, 2016).

The Swedish Confederation of Enterprise's measurements have shown similar results. About half of the member companies consider the regulatory burden as large or very large. Many of the companies surveyed consider that the situation has worsened: 64 percent state that the number of rules has increased over the past two years, 33 percent believe that they could save up to 10 hours a month on simpler regulations, and another 33 percent claim that they could save more than 10 hours a month. As mentioned, these may represent a small cost for a large group, but for smaller companies such resources make a big difference.

Issues of regulatory simplification had a relatively prominent role in the debate on the business climate in Sweden for several years. The center-right government that took office in 2006 set the goal of reducing the administrative cost for companies by 25 percent by 2010. The importance of simple and effective regulatory frameworks was repeated in several of the first budget proposals. A regulatory council – an autonomous public body whose purpose was to ensure that the regulatory burden did not become too extensive – was subsequently established (Koske et al., 2015).

However, the pace of reform has slowed. For example, the deregulation of product markets seen in the periods 1998–2003 and 2003–2008 almost ceased entirely for Sweden in 2008–2013. Countries close to Sweden, such as Finland and Denmark, have continued their reform work, which means that Sweden has lost ground. There are no statistics for the period from 2013, but the situation has probably deteriorated further since then. Liberalization has stagnated during the period 2008–2013 within the OECD and Sweden occupies one of the lowest places in 2013.

Similar results can be found in The Swedish Federation of Business Owners' survey from December 2017 regarding the amount of regulation. It appears that the members of The Swedish Federation of Business Owners spend one day a week on tasks that the state has imposed on them. In the work environment area, there are 72 regulations and 2,000 rules that an entrepreneur needs to obey. It is clear that the number of rules affects smaller firms to a greater extent, which in turn hampers investment, productivity increases, and competition (Företagarna, 2017).

The OECD (2015) divides the regulatory burden into separate categories (state control, barriers to entrepreneurship, and barriers to trade and investment) and 18 subcategories. The study shows that almost all OECD countries declined in all areas in 2008–2013. In the case of Sweden, the situation deteriorated in 9 out of 18 subcategories, an improvement could be seen in 2 areas, and no change in the other 7 areas. In total, government

involvement increased and more barriers to entrepreneurship were created. In parallel with this, it became more difficult to initiate the trade and investment that create both productivity and employment (OECD, 2015). As mentioned, no figures from 2014 onwards were available at the time of writing, however data from 2012 show an increase in the regulatory burden.

The Swedish results in the OECD comparisons vary somewhat, depending on the sector. Sweden performs above average in energy and performs best in the OECD regarding the regulation of service areas such as accounting, law, and architecture. Furthermore, Sweden has the least restrictive regulations for trade, but performs below average in, for example, telecommunications. In the financial sector, both new international and national regulations are implemented continuously. Regulations such as Basel 2 and Basel 3 are often applied jointly in the EU and in the Western world, which means that the political room for maneuver is often limited. In the aftermath of the financial crisis, an intellectual environment has arisen where more and more people favor regulations, not least in the financial sector. Voices are rarely heard saying the financial sector has become too regulated. In the United States, McLaughlin and Williams (2014) showed how the number of restrictions in the code of federal regulations grew by 12,000 a year between 1997 and 2012. There are also indications that growth has become faster since the financial crisis. The researchers could not find a single sector of the economy in which there was a reduction in the number of restrictions.

This is worrying, not least in light of the fact that Fölster and Peltzmann (1997) showed that increased competition is often the main force behind lower prices. The level of entry barriers to firms entering an industry play an important role in determining prices. Regulations create higher entry barriers and, thus, limited renewal of the economy and reduced competitiveness. This is probably an explanation for the weak productivity trend in Sweden, and in large parts of the Western world. Other research groups such as Wölfl et al. (2010) also emphasize that the neg-

ative impact of regulations on competition is particularly problematic. Empirical research have also shown that a higher turnover of companies, both in terms of more people entering a sector and more people leaving it, leads to a more competitive economy, both nationally and regionally (Nyström, 2009; Wennberg & Delmar, 2010).” à ”(Nyström, 2009; Wennberg & Delmar, 2010).

To sum up, Sweden’s competitiveness has declined in several ways in recent years while important work on simplifying rules and reducing regulatory burden has slowed down. In light of the above, a lowered regulatory burden and simpler administrative environment seem to be central to improving Sweden’s competitiveness in future, not least by stimulating more entrepreneurship. Reforms should not need to be particularly costly, so it is strange that more is not being done in this regard.

Taxes on entrepreneurship and risk taking

Taxes on entrepreneurship and individuals are, as stated, an area where Sweden stands out in comparison with the rest of the world. A number of individual taxes as well as the total tax burden have also been increasing in recent years.

Within the framework of Financing of Innovation, several studies have been conducted that demonstrate the need for changes in the tax system. In a report from 2017, 11 start-up companies were interviewed about which policy they have a need/request for. Changes to the hotly debated 3:12 rules that governs the ratio of dividends payable from owner-manager incorporated firms, option taxation, reduced social security charges, reform of LAS, and opportunities to create internships were some of the wishes highlighted by these companies (Elmoznino Laufer, 2017). Although an interview study of this sort does not provide a sufficient basis for whether a particular policy is more effective than another, it does at least indicate the types of policy in demand.

Other Swedish researchers have pointed to the importance of changes in the tax area, not least regarding option taxation (Eklund et al., 2012). For example, options can help companies

with limited paying capacity retain staff where employees can enjoy future possible gains from more uncertain investments. From a growth perspective in particular, options are especially interesting as they can make employers attractive to jobseekers. Key employees often receive options at a low price in the company's initial stages. If the options are written with a longer time horizon, there are also significant incentives for employees to stay in the company. Furthermore, options have the advantage of not involving a direct dilution of the shares in a company. Many entrepreneurs are keen to maintain control of a company in its early stages and therefore do not want to dilute the stock. Options mean that the dilution takes place later in time when any problems with control may not be as tangible.

It is clear, then, that options constitute an important instrument for fast-growing companies to attract and retain talent. Yet, many companies avoid using options as, at the time of writing, marginal taxes amount to more than 60 percent of the profit (Elmoznino Laufer & Wennberg, 2018). Partly as a result of this, option taxation has been the subject of several investigations and referrals in recent years, and the rate has now been reduced for companies with fewer than 50 employees, but as of autumn 2019 the issue is still subject to investigations and appeals.

In general, it can be said that the incentives to start and run companies need to be improved and that this can be done in a number of different ways. There is some empirical evidence that technology development is a public good, at least in the sense that the companies that engage in technology development very rarely perform well over longer periods of time, but that their business entails a spread of technology which in turn leads to growth. This leads to a focus on the incentive structures required for more people to pursue technology-intensive entrepreneurship. A government focused on growth should therefore create better incentives for entrepreneurship and commercialization of research rather than trying to create more companies *per se* (Eliasson, 2000; Delmar et al., 2011).

Legal aspects of innovation and entrepreneurship

Within the research program, legal aspects of innovation have also been studied. In one study, the time spent on patent disputes was compared between Sweden and Germany, England, Holland, and France. The researchers conducted a systematic review of the patent disputes in Sweden and were able to show that the median time for court handling of a patent infringement in Sweden was 36 months, compared to 9 in Germany, 11 in the United Kingdom, 10 in Holland and 20 in France (Bjuggren et al., 2015).

In another study, these infringement cases were shown to be particularly problematic for SMEs to handle. These companies find that the processes negatively affect their position in the market and that they are less likely to apply for a patent, especially in Sweden (Bjuggren et al., 2017). The empirical basis for this study can be described as limited and tentative but illustrates how patent cases are often perceived as traumatic for smaller companies nonetheless.

The above results led to the establishment of a special patent court in Sweden in 2016. A major problem was that, previously, judges did not have a good grasp of the subject of patent law and that cases received low priority. With patent courts an improvement has subsequently been made, and Ratio's research has played a crucial role in achieving this change. Previously, there was an awareness of the problem, but there were no concrete figures and comparisons between countries, which meant that no one knew the extent of the problem.

Within the framework of the research program, some studies of the interaction between corporate governance, innovation, and business growth have also been conducted. Among other things, it has been shown that the Swedish Companies Act does not accommodate smaller companies but mainly suits larger companies, which is problematic since the overwhelming majority of companies in Sweden are small (Almlöf, 2014; Almlöf, 2016). Bjuggren and Almlöf (2015) developed a model for how an optional law such as the Swedish Companies Act can be designed.

Based on these studies, the researchers propose a change to the Swedish Companies Act.

In this sub-area, studies have also been carried out investigating the effects of private equity ownership on corporate performance over time. A study examining 680 acquisitions carried out by Swedish private equity companies during the period 1997–2010 examined how the involvement of the private equity owners affected the long-term performance of the acquired companies, highlighting that companies owned by private equity perform better than other companies (Nordström, 2015). Similar results have been found in prior studies by, among others, Lerner et al. (2011) and Kaplan and Strömberg (2011). This indicates that the often-heard criticism of short-termism on behalf of private equity owners is unfounded.

The role of private enterprise in society

Despite all support schemes, politicians seem to underestimate the importance of entrepreneurship for productivity and economic growth, and also consider the climate for entrepreneurship to be better than entrepreneurs themselves do (e.g. Nyström, 2013). A number of Swedish surveys, as well as industry representatives and leading entrepreneurs' assessments, indicate that this is a critical condition for entrepreneurship (Karlson & Larsson, 2016).

At the local level, this may be about the lack of understanding from municipal officials and politicians about the actual conditions under which entrepreneurs operate, and/or how various rules are actually applied. From an entrepreneur's perspective, the regulatory burden depends both on the total amount of regulations and details of each piece of regulation. Public authorities however monitor specific pieces of regulation, meaning that their understanding of how various regulations contribute to the overall bureaucratic hurdles and workload for entrepreneurs is often very limited (Falkenhall & Eklund, 2010).

At the national level, this might concern the negative attitude that politicians have toward competition and profits in im-

portant service markets. The notion of what constitutes fertile entrepreneurial conditions also differs fundamentally between politicians – at least in the Swedish Parliament – on the one hand, and the entrepreneurs on the other, where the latter have a considerably more critical attitude. However, public attitudes toward entrepreneurship have become increasingly more positive over past decades.

This is important because cognitive frameworks and mental models have an impact on the policies of a country. Although economic self-interest partly decides how people vote and how politicians act, it is also clear that perceptions of the world and what is right and fair are of great importance too (Karlson, 2018; McCloskey, 2010).

In other words, ideas and values can determine the fate of an industry. The Swedish Telecommunications Administration was larger, more powerful, and technically superior to the small private firm Comvik in the 1980s, but this did not prevent Comvik from getting its way in the political sphere. The public disapproved of the Telecommunications Administration to the extent that, on some occasions, politicians and officials acted in Comvik's favor such that more competition was principally and practically preferable to the Telecommunications Administration's monopoly position (Laurell et al, 2018). Conversely, agents of change who are not perceived as legitimate may encounter more resistance in the political sphere. This means that policy on innovation and entrepreneurship is not solely governed by self-interests. Opinions concerning business and entrepreneurship play a role. The lack of basic respect and understanding of corporate logic and conditions is then reflected in the view of profits, taxes, and what contribution to society companies stand for.

The idea of the entrepreneurs' right to profit in the welfare sector has become particularly relevant recently. Anyone who chooses to see profit as money the entrepreneur makes at the expense of welfare will of course be critical of both profits in the

welfare sector and companies in general. But profit can also be seen as the reward a company earns for doing something that society appreciates. If a company can charge more than the cost of the resources that are used, value has been created. Part of this value goes to the entrepreneur, who in turn can choose to reinvest these funds in the business.

The market economy involves a dynamic process where new goods, services, and processes are introduced continuously, which in turn leads to price-reducing measures, lower costs, and imitation. Profit is ultimately about the right and the opportunity to create greater value for society. In the long run, the view of the corporate social role and the view of profit govern how formal institutions around enterprise are designed.

A need for reforms

Over the past decade, innovation policy has increasingly been regarded as a collection of public support schemes rather than a more holistic set of conditions affecting the long-term quantity and quality of new innovative firms (Eklund et al. 2012), against prevailing knowledge of the crucial determinants of long-term quantity and quality of entrepreneurship and productivity-enhancing innovations (e.g. Aghion et al., 2009; Gennaioli et al., 2013). Rather than being directed by the comprehensive body of research and building a holistic system geared towards innovation, policymakers have tended to tinker with various programs and minor reforms. Since the effectiveness of such programs are often questionable and taken together, they serve to increase selectivity, bureaucracy and regulatory burden, the overall importance of entrepreneurs and competitive markets for the emergence of innovations have partly been lost in the process (Aghion et al., 2009; Caves, 1998; Jovanovic & MacDonald, 1994).

The results from empirical studies in the Financing Innovation research program together with comparative international research indicate that this has been a mistake: Alleged market failures have been replaced by policy failures. The combination

of various types of information problems where authorities and public actors have been given tasks that they often cannot accomplish, and incentive problems where companies are lured away from focusing on their competitive capabilities has affected the actions of both public and private actors.

One reason for this development is that it is easier politically to enact various forms of support schemes that assess the long-term conditions for innovation. The costs of the support (i.e., taxes) are widely distributed, while the damages in the form of distorted competition, administration, opportunistic behavior, etc. are highly indirect in nature and difficult to quantify. The beneficiaries of a certain support policies – when these do work – are comparatively few but homogenous in nature. A recent example includes Europe’s largest privately held ski resort operator Skistar with operations in sparsely populated regions where startups are eligible for public grants. By starting wholly owned subsidiaries to construct new ski lifts, Skistar was able to receive over €7,000,000 in public grants, with no formal independent evaluations of the positive effects on the regions where investments are made (Svenska Dagbladet, 2019). Such grants are easily exploited by large corporations seeking to improve their oligopoly power, with costs borne directly by taxpayers and indirectly by smaller competitors. Politicians can showcase their good intentions and appear as business-friendly, recipients of support will perceive them as valuable, and those who distribute these funds or administer support functions will also be in favor of such systems.

The opposite applies to reforms with the broader purpose of improving the institutional conditions for firms. The benefits of such changes should, as stated above, be significant and benefit all companies, meaning that positive effects are distributed over a wide range of actors. Conversely, costs are often concentrated in different types of special interests. This applies to politicians, public administration, and the business community (Potts et al., 2016). While such “broader” reforms are unanimously declared

“the most important” for enhancing the quality and quantity of innovation and entrepreneurship (e.g. Braunerhjelm et al., 2012; Acs et al., 2016) together small business financing (e.g. Beck et al., 2008), they are notoriously difficult to act upon and prioritize for lawmakers. As Josh Lerner (1999) writes:

It is necessary to ensure that entrepreneurship itself is an attractive option. Often, in their eagerness to get to the “fun stuff” of handing out money, public leaders neglect the importance of setting the table, or creating a favorable environment. Many entrepreneurs come not from academia, but rather from corporate positions, and studies have documented that, for these individuals, the attractiveness of entrepreneurial activity is very sensitive to tax policy. Also important is ensuring that the law allows firms to enter into the needed contracts—for instance, with a potential financier or a source of technology—and that these contracts can be enforced. Finally, education is likely to be critical. Ensuring that business and technology students are exposed to entrepreneurship classes will allow them to make more informed decisions; and creating training opportunities in entrepreneurship for midcareer professionals is also likely to pay dividends.

(Lerner, 1999, p.13)

Because innovation contributes to creative destruction, it is not uncommon that different interest groups have strong incentives to block the innovation process. Established interest groups often possess financial and social capital that allows them to prevent the spread of innovation (Juma, 2017). New entrants often lack these assets. Successful innovation policy is therefore essentially about conducting a policy that does not result in so-called “regulatory capture,” where different special interests, rather than a broader public interest, dominate and maintain existing regulations, taxes, and other public interventions.

7. Conclusions and Recommendations

Innovation is about the commercialization of new knowledge. An innovation is something new – a product, process, or business model – of commercial value. The prerequisite for innovations is entrepreneurship and functioning markets. There is a strong connection between innovation, economic growth, and prosperity.

What more general conclusions can be drawn from the Financing of Innovation research program? How can the interaction between financing and entrepreneurship be improved to facilitate innovation, competitive production, and sustainable growth?

An important conclusion is the need for a more holistic approach to innovation policy with a focus on competence supply and the institutions of the market economy rather than seeking to control or direct the development in specific sectors or cater to specific firms. The growth challenges that new and fast-growing companies face when it comes to developing new and competitive products and services are complex. The same applies to larger, established companies. It is just as much about difficulties in attracting competence, complicated regulations, and other shortcomings in the entrepreneurial conditions as it is about getting funding. Lack of capital does not seem to be a major problem. In the vast majority of cases, the capital markets function well, and private actors are best suited for managing the risk posed by the financing of innovation. History is riddled with scandals and large malinvestments showing that bureaucracies cannot ‘pick winners’ or predict where future in-

novations will arise. Instead, attempts to resolve alleged market failures often create policy failures due to various information and incentive problems.

Direct financial support to specific companies today amounts to large sums, in Sweden as well as almost any developed or developing nation. Studies carried out within Ratio's Financing of Innovation program show that the effects of such support fall short of policymakers' expectations as the projected gains on turnover, profit, number of employees, and innovativeness are non-existent. Similar results are also found in many international studies.

Since there are many different agencies that distribute support, with little coordination between them, some companies can also exploit these structures and become experts at writing grant applications (as opposed to enhancing the productivity in their firm) thereby appropriating a large number of grants. We call these firms "subsidy entrepreneurs."

Studies from a variety of countries also highlight that the risk of corruption increases with the number and size of various government subsidies for businesses. In light of such unattractive side effects and the lack of robust evidence for positive effects of subsidies, there are indeed reasons to question whether this is an effective use of tax funds. Also, state aid of this kind, in so far as it should exist at all, should be designed in such a way that makes it easy to evaluate. As Lerner writes in his book *Boulevard of Broken Dreams*:

Another danger in implementation is the failure to design appropriate evaluative mechanisms. Ideally, programs will undergo careful scrutiny at two levels. First, the program itself will be carefully analyzed. While designers should recognize that any initiative will take time to bear fruit, it is important to periodically take stock of which of its aspects appear to work well and which do not. Second, fund managers and firms participating should be scrutinized. It is important to ensure

that the groups benefiting from government programs are the most promising in the industry in terms of market performance and can most benefit from public investment, rather than being those most adept at currying favor with the people who are handing out public funds.

(Lerner, 1999, p.14)

Another conclusion is that private financing through own savings, business angels, or VC companies is fundamental to the financing of innovation. Competent capital is capital that has been generated under competition in markets. Therefore, reforms that improve the conditions for the emergence of more private financiers and forms of financing are important. A low tax rate on capital is thus essential for future innovative entrepreneurship. In addition, there are other rules and laws that appear to be important. In Sweden, this includes questions about variability in and the bureaucracy associated with various taxation rules (Alstadsæter & Jacob, 2016), stock option taxation (Henrekson & Sanandaji, 2018), and social security contributions, but it is also about making it more attractive to establish, develop, and expand companies.

Particularly important is the supply of competence for fast-growing companies. Many innovative companies experience competence shortages, while established companies that are facing technology shifts also report problems in finding the right competencies. The quality, efficiency, and relevance of the education system need to increase. In addition, the labor market needs to be more flexible to improve the allocation of skills in the economy.

A clearer division of labor within the innovation system must not be overlooked. Universities play an important part in the supply of the competencies necessary for both established and new companies. However, universities themselves can rarely be regarded as sources of pioneering innovation, although important exceptions exist. So-called academic entrepreneurship

seems to produce limited results in comparison with student start-ups as well as start-ups by experienced managers.

An overall conclusion is that an innovation policy for economic growth needs to have a broader focus than today. Clearly, to improve the institutions of the market economy rather than to support bureaucrats are decisive for a successful innovation policy. Greater focus needs to be placed on innovative output, rather than input in the innovation process. In Sweden, as well as many other European economies, an alleged lack of capital and the fact that the capital markets do not work well enough has meant that other important conditions for entrepreneurship and innovations have not received the attention they deserve. The studies in Ratio's Financing Innovation research program rather demonstrate the prevalence of policy failures, that is, public money being spent on activities that have little or no effect on increasing the quantity or quality of innovation.

Capital is seldom the main bottleneck for a more innovative and entrepreneurial economy, at least not in Sweden. However, there are several areas where there is a great need for reforms, which do not necessarily incur significant costs for taxpayers. Competencies and well-functioning market institutions that promote innovation and entrepreneurship are much more vital for a more innovative economy. Ratio's studies in the Financing of Innovation program has identified a number of areas in which there is a need for reform.

1. Improving companies' access to competence appears to be very important.
2. The regulatory burden needs to be reduced through improved government practice and application of rules to lower the barriers to market entry and allow for a level playing field between new and incumbent firms.
3. A reduction in individual taxation appears to be most urgent to enhance conditions for entrepreneurship as well as the funding of new innovative enterprises. This concerns margi-

nal taxes to some extent but also more reasonable stock option taxation.

4. One of the most important bottlenecks in the Swedish economy which we have only touched on indirectly here is the lack of housing under current regulations.
5. There are indications that Corporation Law also needs to be reviewed in order to better fit the needs of family-owned companies. These conditions are not unique to Sweden. As growth theorist Philippe Aghion and a number of notable economists wrote in The Sapir Report outlining a growth agenda for the European economy:

What is needed now is more opportunity for new entrants, greater mobility of employees within and across firms, more retraining, greater reliance on market financing, and higher investment in both R&D and higher education.

(Sapir et al., 2004, p 230)

Some of these areas are associated with significant political deadlocks, where different special interests monitor existing laws, rules, and policies. Hence, instead of various government schemes associated with limited positive effects and considerable downsides in terms of distorting incentives and resulting in administration among firms and governments, an innovation policy that actually results in more innovation and entrepreneurship is needed.

8. References

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Appendix

Publications from the Financing of Innovation research program

Publications are listed below, arranged by area of research.

1. Financing of new and fast-growing companies

ACCEPTED AND PUBLISHED ARTICLES

2017

- Coad, A., Daunfeldt, S-O. & Halvarsson, D. (2018). Bursting into life: firm growth & growth persistence by age. *Small Business Economics*, 50(1), 55-75.
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- Wennberg, K. & DeTienne, D. R. (2014). What do we really mean when we talk about 'exit'? A critical review of research on entrepreneurial exit. *International Small Business Journal*, 32(1), 4-16.

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- Bjuggren, P.-O. & Elmoznino Laufer, M. (2015). Startups, Financing & Geography – Findings from a survey. Ratio Working Paper No. 255.
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2. Financing disruptive innovations

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Sandström, C., & Karlson, N. (2016). *Digital disruption: konsekvenser för företagande, individer och samhälle*. Stockholm: Ratio.

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3. Public support and innovations

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Author Presentations

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