Human capital and business stay-up
the relationship between education, skills and entrepreneurial success

Gabriel Heller Sahlgren
Research report 12

CENTRE FOR EDUCATION ECONOMICS
23 Great Smith Street, Westminster, London SW1P 3DJ · www.cfee.org.uk
Human capital and business stay-up
the relationship between education, skills and entrepreneurial success

Gabriel Heller Sahlgren
About the author
Gabriel Heller Sahlgren is lead economist at the Centre for Education Economics (CfEE), an affiliated research fellow at the Research Institute of Industrial Economics in Stockholm, Sweden, and a PhD student at the London School of Economics. He is the author of numerous publications on issues relating to applied microeconomics, including ‘Smart but Unhappy: Independent-school Competition and the Wellbeing-efficiency Trade-off in Education’.
ACKNOWLEDGEMENTS

This publication reports the findings of research commissioned by The Entrepreneurs Network (TEN) and funded by the Association of Business Executives (ABE) to inform its Business Stay-Up campaign. The author wishes to thank Network director Philip Salter and the campaign’s board of advice for their valuable comments and discussions.

Philip Alexander, People Platform
James Callander, Freshminds
Dr Dababrata Chowdhury, University of Suffolk
Lord Cromwell
Dr Spinder Dhaliwal, Westminster Business School
Alex Evans, The Supper Club
Dr Christopher Haley, Nesta
Catherine Marchant, Bright Ideas Trust
Rob May, Association of Business Executives
Fiona Melville, Accelerated Digital Ventures
William Oswald, Association of Business Executives
Guy Rigby, Smith & Williamson
Bryony Simpson, Engineers for Pioneers
Keiron Sparrowhawk, MyCognition
Ian Walters, Metro Bank
Naomi Weir, Campaign for Science and Engineering

We are especially grateful to the Association of Business Executives (ABE) for its funding of the campaign.
About Business Stay-Up
This publication reports the findings of research commissioned by The Entrepreneurs Network (TEN) and funded by the Association of Business Executives (ABE) to inform its Business Stay-Up campaign.

Business Stay-Up is a research-led campaign to raise awareness of the pressures and challenges business owners face as they seek to survive and scale, and understand what can be done to increase the probability of success.

ABE is a not-for-profit organisation which provides internationally recognised qualifications and a worldwide professional association for business executives. The Association’s social purpose is to improve business education for aspiring entrepreneurs, particularly those in developing countries.

The Entrepreneurs Network is a think tank working to bridge the gap between entrepreneurs and policymakers. It provides the Secretariat for the All Party Parliamentary Group (APPG) for Entrepreneurship, which sits across the House of Commons and House of Lords, and is the instigator and campaign manager of The Leap and Female Founders Forum.
THE EMERGENCE OF a global start-up culture came at just the right time. Even before the 2007-2008 financial crisis, many people across the world were taking an entrepreneurial turn – a trend that has shown no sign of dissipating.

But of course, start-ups alone are not a panacea for all economic ills. We need some of those businesses to grow, for it is among the fastest of these that employment growth, innovation and productivity gains are strongest. That is why governments, particularly in the developed world, have diverted their attention from start-ups to scale-ups – companies, that is, that are showing growth, from a solid base, of 20 per cent per year over three years.

Broader attention to the nitty gritties of helping those at the margin – understanding if the high percentage of start-up failures are really necessary, and whether we can convert more start-ups to scale-ups – is now required. This is the goal of Business Stay-Up: a research-led campaign to raise awareness of the pressures and challenges business owners face as they seek to survive and scale, and understand what can be done to increase the probability of success.

Obviously, we cannot, and should not seek to try to, prevent all businesses from failing. Business failure is integral to a well-functioning market economy. Without the churn of underperforming firms going bankrupt, resources wouldn’t be reallocated to better use. Nevertheless, we should want as many firms as possible firing on all cylinders – both to avoid unnecessary failure at the individual level, but also to increase productivity at the macro level.

Governments have plenty of levers for supporting entrepreneurs, but not all of them are backed by an equal weight of evidence as to their effectiveness. As this paper shows, one increasingly well-researched policy area relates to improving management practices. This paper adds to this growing body of evidence, new research supporting the importance of human capital to entrepreneurial outcomes.
In this ground-breaking work, author Gabriel Heller Sahlgren finds a relationship between business owners’ specific areas of qualification and the growth of their enterprise, and most importantly that all areas of study are not equal in terms of stimulating success. The training obtained through programmes in business, social science, and law, and in technical areas, such as engineering, appears to lead to employee growth – whereas programmes relating to other subject areas do not.

Heller Sahlgren puts the case that governments need to investigate further as they seek ways to incentivise training in these high impact areas, and in management skills specifically. The most promising approaches, he finds, appear to focus on task-related training, in both an operational and content-specific sense. To maximise the probability of firm success, owners must learn the operational skills of organisation and management, but must also keep up-to-date with the latest developments in the field in which they operate.

The Business Stay-Up campaign is pleased to endorse these findings. Education and skills are vital not only for securing high numbers of start-ups – but also to making sure those start-ups survive and grow into flourishing businesses.

More can and should be done to raise the probability of firm survival. For policymakers in the field of entrepreneurship, identifying and incentivising interventions to help firms survive and thrive should be of the highest priority.

Philip Salter
Founder, The Entrepreneurs’ Network
Secretariat, All Party Parliamentary Group for Entrepreneurship, Westminster

September 2018
Executive summary

IN THE LAST DECADES, governments worldwide have used different policy tools to increase entrepreneurship rates in their countries. For example, in the UK, since 2010 especially, the government has introduced a swath of policies designed to stimulate start-up development, including the provision of start-up loans, research and development tax reliefs, reduced capital-gains taxes, and tax reliefs for investors in new companies.

Stimulating entrepreneurship is certainly a worthwhile goal. However, much more must be done to raise entrepreneurial success and the chances of firm survival. While much effort has been given to supporting start-ups, relatively little attention has been paid to factors relating to ‘business stay-up’. To ensure that the start-up agenda does not end in failure, it is important to devise new policies to help improve entrepreneurial quality.

This paper first discusses the theoretical mechanisms behind education and human capital and firm success. It then surveys the evidence on the role of education in spurring higher-quality entrepreneurship. To shed more light on the type of training that is likely to be necessary, it goes on to provide a new quantitative analysis of about 10,500 business owners, investigating the types of education that best predict firm size. Firm size is an important indicator of high-quality entrepreneurship, as it is suggestive of businesses’ potential as innovators and future drivers of growth.

Existing research suggests that general human capital – such as the number of years of schooling – increases high-quality entrepreneurship. Some research also indicates that education in business and scientific subjects is especially important, an effect that appears to operate through better use of management practices. Furthermore, specific training programmes designed to improve business stay-up rates, and broader ones designed to improve performance more generally, appear to have been successful to the extent they improve management skills specifically.
Building on this research, our analysis of PIAAC data indicates that in comparison to general programmes, qualifications specifically in business, social science, or law are more strongly related to firm size, once holding constant other important predictors.

We also find positive relationships between firm size and training in engineering and science, although these relationships are weaker than the relationship between firm size and qualifications in business, social science, and law.

The effects may operate through coordination, since managers with business degrees may be better at strategy and marketing, and adaptability, since managers with science and technical degrees should be better equipped at adopting new technologies.

While some entrepreneurs will obtain the training they need in the context of full-time formal education, it is reasonable to assume many will obtain it through relevant adult education and training. We show that there are large differences in the take up of job-related adult education and training among business owners in different countries – but also that there is considerable capacity to increase training in all countries.

To stimulate investment in training, we propose that governments worldwide: (1) provide tax relief for small-business owners to invest in learning programmes that are focused on improving their businesses; and (2) identify more precisely what works through sponsoring randomised trials of promising training approaches. While investment in human capital is not the only measure necessary to improve entrepreneurial success, it is likely to be a key factor in this endeavour.
I. Introduction

IN THE LAST DECADES, governments worldwide have used different policy tools to increase entrepreneurship rates in their countries. For example, in the UK, since 2010 especially, the government has introduced a swath of policies designed to stimulate start-up development, including the provision of start-up loans, research and development tax reliefs, reduced capital-gains taxes, and tax reliefs for investors in new companies.

Overall, stimulating entrepreneurship is certainly a worthwhile goal. Indeed, recent research indicates that new businesses create a disproportionate share of new jobs – and that a small number of fast-growing businesses entirely explain differences in employment growth across a number of countries (Anyadike-Danes et al. 2014; Haltiwanger et al. 2013; Henrekson and Johansson 2010). Supporting entrepreneurship is therefore important to attain high employment and economic growth in future.

However, much more must be done to raise entrepreneurial success, including the probability of firm survival – or ‘business stay-up rates’. For example, of all firms started in the UK in 2010, only 41 per cent remained active five years later (ONS 2016). The picture is similar in other countries worldwide. To ensure that the start-up agenda does not end in failure, it is important to devise new policies to help improve entrepreneurial quality. Future entrepreneurship policy must not merely focus on increasing the rates of entrepreneurship – but also identify and set in motion mechanisms to support sustainable entrepreneurship specifically.

Certainly, firm performance depends on a number of factors, including investments in research and development, decisions about firm structure, and the regulatory environment (Syverson 2011), but an expanding literature highlights the importance of education and human capital, as suggested by the relationship between the shares of unicorns/self-made billionaires and education levels across countries (see Henrekson and Sanandaji 2014, 2017). In other
words, education and skills are likely not only to be crucial for securing high numbers of start-ups – but also to making sure those start-ups survive and grow into flourishing businesses.

This paper discusses the theoretical mechanisms at work in how human capital relates to firm success, and surveys the evidence on the role of education in spurring higher-quality entrepreneurship. This evidence analyses the role of different types of education, including general human capital levels, business education, entrepreneurship education, as well as specific types of training designed to improve entrepreneurial success.

Overall, existing research suggests that human capital does indeed increase high-quality entrepreneurship. Some research also indicates that education in business and scientific subjects is especially important to ensure firm success, an effect that appears to operate through better use of management practices. Indeed, better management practices – which, broadly speaking, involve the use of monitoring, targets, and incentives – are positively related to a range of indicators of firm success, an effect that research suggests is causal. Furthermore, specific training programmes designed to improve business stay-up rates, and performance more generally, appear to have been successful to the extent they improve management skills specifically.

To shed more light on the type of training that is likely to be necessary, the paper provides a new quantitative analysis of about 10,500 business owners in 21 European countries, using data from the OECD’s Programme for the International Assessment of Adult Competencies (PIAAC) survey. The research investigates the areas of study and types of education that predict the number of employees these business owners have working for them, which is an important indicator of firm success. The results indicate that qualifications in business, social science, or law are quite strongly related to firm size compared with general qualifications, once holding constant other important predictors (including the business owner’s own absolute educational level and test scores). There is also evidence that engineering and science qualifications are positively related to firm size, albeit more weakly so compared with qualifications in business, social science, and law.

As high levels of human capital appears essential to successful high-impact entrepreneurship, governments should seek to improve access to relevant education and training for owners and managers of start-ups. Our reading of the literature and our own analysis suggests the importance of task-related training, in both an operational and content-specific sense. To maximise the probability
of firm success, owners must learn the operational skills of organisation and management, but must also keep up-to-date with the latest development in the field in which they operate.

While some may obtain such training through full-time formal education, it is more reasonable to assume they will obtain it through adult education and ongoing training and access to relevant learning programmes. We show that there are large differences in the take up of job-related adult education and training among business owners in different countries – but also that there is considerable capacity to increase the take up of training in all countries.

The training needs of businesses will vary depending on the field, but the safest bet would be to incentivise companies to invest in training that raises management skills specifically. Good management practices – and education improving such practices – have been proven to predict firm success in a wide range of sectors. At a more general level, our findings support this.

To stimulate investment in these types of training, we propose that governments worldwide: (1) provide tax relief for small-business owners to invest in learning programmes that are focused on improving their businesses; and (2) identify more precisely what works through sponsoring randomised trials of promising training approaches. While investment in human capital is not the only measure necessary to improve entrepreneurial success, it is likely to be a key factor in this endeavour – and governments worldwide should do whatever they can to support it.
2. Education, high-impact entrepreneurship, and economic growth

Why would we expect human capital to affect high-impact entrepreneurship? According to economic theory, human capital is often seen as essential for raising countries’ development levels (see Heller Sahlgren 2014). And to raise human capital levels, it is in turn key to ensure access to high-quality education and training for the general population. Indeed, stimulating growth through educational reforms has become a popular strategy among politicians worldwide. For example, in 2011, speaking to the Education World Forum, then Education Secretary Michael Gove (2011) claimed that ‘the single most effective way to generate economic growth is [to] invest in human and intellectual capital – to build a better education system’. Of course, human and intellectual capital does not only stem from school-age education; there is an important role for adult education and training as well (Heller Sahlgren forthcoming).

In support of reforms to advance skill accumulation in the population, the link between human capital and economic growth is well established. Indeed, research suggests a strong relationship between countries’ skill levels, measured by aggregate pupil test scores, and economic growth. Interestingly, this research also suggests that the average years of schooling in the population are unrelated to economic growth when accounting for the direct impact of skills, indicating that schooling as such only matters to the extent it improves skills (e.g. Hanushek and Woessmann 2012; Heller Sahlgren 2014). However, test scores pick up both cognitive and non-cognitive skills – such as conscientiousness – and both
components have been found to have similar effects on economic growth rates (Balart et al. 2018). Overall, this indicates that skills captured by test scores are an important ingredient for stimulating countries’ growth rates.

Similarly, the evidence suggests a positive individual-level relationship between human capital and skills and labour market outcomes, such as wages and employment (Hanushek et al. 2015). The importance of non-cognitive skills in the labour market also appears to have grown significantly over time, suggesting that the broader skills attained through education are becoming more important than ever (Deming 2017; Edin et al. 2017). There is little doubt, therefore, that human capital is crucial for labour market success at the individual level.

There are several mechanisms through which human capital affects economic success, but one of them is likely to be successful entrepreneurship. At a general level, a wide range of studies indicate that entrepreneurship predicts economic growth and innovation (see van Praag 2007; van Praag and Versloot 2007). However, due to data availability, most research measures entrepreneurship using rates of self-employment, the number of start-ups, and small business activity – which neither capture the definition used in theories of entrepreneurship nor the goal of entrepreneurship policy: to stimulate the emergence of disruptive Schumpeterian entrepreneurs as innovators and drivers of growth. Most small businesses are neither innovative nor interested in growing to become large, successful companies; most small businesses and start-ups in Europe and America have no employees other than the owner (see Henrekson and Sanandaji 2014, 2017; Shane 2009).¹ It is therefore not surprising that there is in fact a strong negative relationship between self-employment rates and the level of economic development across OECD countries, as displayed in Figure 1.² Merely focusing on stimulating start-up and small business development is therefore unlikely to be a successful long-term growth strategy.

¹ In support of this, the self-employment boom in the UK between 2001 and 2016 is entirely explained by an increasing number of self-employed without any employees – in contrast, there has actually been a decline in the number of self-employed with any employees (ONS 2018).
² The data for the analysis were retrieved from the OECD’s (2018) databases. The data on self-employment rates include 31 out of the current 35 OECD countries.
Instead, it is crucial to stimulate high-impact entrepreneurship in such a way that allows new companies to survive and grow to become drivers of innovation and economic growth. In other words, we need to focus much more on the quality than the quantity of entrepreneurship (Shane 2009). For example, of all firms started in the UK in 2010, only 41 per cent remained active five years later (ONS 2016). Increasing the number of business owners is simply not always a helpful approach from a policy perspective (van Praag and van Stel 2013). To ensure that the start-up agenda delivers the type of high-impact entrepreneurship that policymakers seek to encourage, it is therefore crucial to devise new policies that both help raise business survival rates and ensure that firms grow.

To achieve this goal, it is in turn likely to be important to promote human capital development among managers specifically. Indeed, empirical research indicates that manager ability matters greatly for firm performance (e.g. Bertrand and Schoar 2003) – and if this relationship reflects the impact of teachable traits and characteristics, it should be possible to improve manager ability through education and training. Human-capital theory assumes that people seek compensation for their investment in education and training, and

![Figure 1](image-url)

The relationship is statistically significant at the 1% level
it therefore predicts that business owners who have invested in education more than others are likely to strive for higher profits and growth compared with business owners who have invested less in their education (Cassar 2006). The entrepreneurship literature in turn suggests several mechanisms explaining how human capital should increase entrepreneurial success, including stronger managerial capability to discover and exploit business opportunities, capacity for planning and venture strategy, ability to raise capital, as well as ability to acquire new knowledge and skills of importance for firm success (see Unger et al. 2011). Overall, therefore, education and training that increase human capital among business owners and entrepreneurs should theoretically be related to firm success.

Arguably, human capital may also be more important in young businesses than in old ones. The former suffer from the “liability of newness” and are more likely to fail compared with the latter. This may in turn depend on gaps in skills and information. Owners of young businesses constantly have to respond to new and different tasks, as strategies and routines have not yet been set – and possession of the right skills may help them adapt to new situations better (see Unger et al. 2011). This suggests that human capital among business owners of relatively new firms is likely to be more important than for business owners of older firms.

Of course, there are a lot of different types of education and training and not all types will be equally successful. To maximise the possibility that start-ups will ‘stay-up’ – raising firm survival and sustainable growth in the market place – it is important to analyse what types of training are most likely to be successful for this purpose. The next section discusses the empirical evidence on the importance of human capital for firm success, both at a general level and for different types of education and training.
HAVING DESCRIBED THE THEORETICAL relationship between human capital and high-impact entrepreneurship, it is important to consider the empirical evidence on the topic. Such empirical evidence is key for drawing policy conclusions, since any effects are likely to depend on the type of education and training provided. All human capital is not equal and it is important to understand what types are most likely to support high-impact entrepreneurship and firm success.

3.1. General human capital

On average, research does indicate that human capital at a general level – as captured by higher levels of education and skills – does have positive effects on successful entrepreneurship. This is evident from a meta-analysis covering 70 studies with an overall sample size of almost 25,000 people, which indicates that human capital in different forms does indeed predict firm success as measured by firm size, growth, and profitability. The effect on firm size is especially pronounced. Supporting the theoretical argument noted in Section 2, this research also indicates that human capital is especially important for younger businesses. According to the findings, and in support of the research on the relationship between education and economic growth discussed in Section 2, the outcomes of human capital investments, measured in the form of knowledge and skills, matter more than the level of investment input (see Unger et al. 2011). Nevertheless, overall, both human capital investments and the outcomes of such investments positively predict entrepreneurial success.

---

We note that the micro-level relationship between education and firm success is supported by research finding that higher educational levels among political leaders have positive effects on economic growth at the macro level (Besley et al. 2011).
For example, in England, Saridakis et al. (2008) find that having a founder with a university degree positively predicts business survival among small firms in the period 2001–2004, indicating a positive relationship between education and entrepreneurial success. Similar findings are displayed in China, where Kong and Zhang (2010) show that the educational level of managers is positive for publicly listed companies’ operating and market performance. This holds true also when studying how changes in managers affect changes in firm performance over time. The same substantive findings are reported by Cheng et al. (2010) and Mukherjee and Nguyen (2018).

Furthermore, more recent research finds that education appears to be especially important for high-impact entrepreneurs specifically. Levine and Rubinstein (2017) disaggregate the self-employed in America into those who have incorporated their businesses and those who have not. They show that incorporated businesses are a better proxy for proper entrepreneurship, as they tend to engage in activities that demand strong cognitive skills to a much higher extent than unincorporated businesses. Incorporated business owners also tend to be much more likely to be university graduates and score higher on learning aptitude tests on average. In support of this, research on self-made billionaires—which perhaps are the most successful high-impact entrepreneurs of all—shows that they tend to be much more likely to have research degrees than the average person (Sanandaji and Sanandaji 2015). This further supports the idea that knowledge and skills are important for high-impact entrepreneurship specifically.

Still, with only a couple of exceptions, a general problem with the literature on the effects of general human capital on firm success and high-impact entrepreneurship is that it tends to ignore that education is not random. Individuals self-select into education based on many attributes, which in turn may positively affect business success. If so, this may bias the findings regarding the relationship between human capital and entrepreneurial success, which few papers investigate.

Interestingly, they also find that people who both participated in illicit activities and scored highly on aptitude tests as teenagers have a much greater tendency to incorporate than others. This suggests that high-ability individuals who tend to break rules as youngsters are most likely to become high-impact entrepreneurs.

The importance of this is highlighted by Asoni and Sanandaji’s (2016) contribution, which finds that having a college education does not decrease the probability of moving from self-employment to unemployment once accounting for this issue, although cognitive skills still prevent the likelihood of failure among men. This paper focuses solely on self-employment rather than high-impact entrepreneurship, but it is plausible that the problem applies to the latter as well.
However, in a recent contribution, Queiro (2016) avoids the selection problem when analysing administrative data covering all firms and workers in Portugal in the period 1995–2009 to study the relationship between manager education and firm growth. He finds that firm growth increases considerably when companies switch to university-educated managers compared with firms that switched to managers with 12 or fewer years of schooling. Trends in performance before the switches are very similar, suggesting this effect is causal. He also finds that the effects of permanent manager exit from the labour force before the age of 60 – which appears to be due mostly to deaths and therefore unlikely to be a result of firms’ prior performance – support his general findings: losing a more educated manager leads to lower firm growth. Overall, the paper therefore indicates that education as such in fact is causally related to firm success.

3.2. Specific types of human capital

While the impact of human capital on the probability of entrepreneurial success as such is important, it does not help us understand what types of training are most effective from this point of view. It is therefore important to consider research analysing specific types of education and training.

And this research suggests that human capital indicators more closely linked to entrepreneurial tasks – such as business experience, organisation, management, and knowledge of importance for the sector in which the firm is competing – are better predictors of entrepreneurial success than indicators less linked to entrepreneurial tasks, such as general education and employment experience (Unger et al. 2011). In support of this, research from Denmark shows that serial entrepreneurs – who open more than one business – have more sales and employees than novice entrepreneurs (Shaw and Sørensen 2017). While the above caveat regarding research quality applies here as well, this indicates that management skills and prior experience of running a business are more important than general educational performance as determinants of firm success.

Importantly, more recent and better research supports the former. Indeed, an expanding literature suggests that higher quality management practices – the use of monitoring, targets, and incentives – are strongly related to firms’
performance and likelihood of survival in different sectors. Furthermore, randomised research suggests this relationship is causal: using external consultants to work with managers to improve their management practices raises firm performance over time compared with a control group of firms (see Bender et al. 2018; Bloom and Van Reenen 2007, 2010; Bloom et al. 2013). This indicates that good management skills are not innate – but can rather be improved through relevant education and training.

This is further supported by the fact that the education level of the managers positively predicts the quality of the management practices utilised (Bloom and Van Reenen 2007) and evidence also suggests this relationship is causal at least when it comes to incentive pay (Queiro 2016). Interestingly, research also indicates that hospitals that are located closer to universities that offer both medical and business education have more MBA-trained managers, higher management quality – and higher performance. However, this relationship does not hold when the universities nearby only offer either business or medical education (Bloom et al. 2017), suggesting that both content and the operational task-relatedness of managers’ education is important for stimulating higher performance. In other words, the positive impact of managers’ human capital levels appear to operate at least partly through the adoption of better management practices.

The positive impact on management practices may also explain why business education in some cases appears to have especially positive effects on firm performance more generally. For example, Chemmanur et al. (2014) use draft deferment rules to predict whether individuals entered graduate school in the Vietnam War period, finding that the fraction of managers with MBAs in fact do predict better long-term firm performance. While not studying the effects of graduate degrees specifically, Queiro (2016) shows that the positive impact of having a business degree in Portugal is larger than having a humanities or other non-technical degree. Yet the effects of health, science, and engineering degrees

---

6 The quality of management practices is measured in interviews with managers about whether they use practices in 18 dimensions in three broad areas: (1) how the companies monitor what they do and utilise this to raise performance; (2) whether the companies set correct targets, track correct outcomes, and take action when the two are not aligned; and (3) whether the companies reward and promote employees based on performance, while seeking to hire and retain their best-performing employees (see Bloom and Van Reenen 2010).

7 This holds true for research attempting to take into account that the choice to enter different types of education in the first place is not random, which we highlight here. The correlational evidence that ignores such issues is a bit mixed, with some studies finding positive effects and others no effect at all (e.g. Gottesman and Morey 2010; Bhagat et al. 2010)
are larger still. The results therefore indicate that the human-capital effect on firm success partly operates through adaptability, since managers with more technical degrees should be better equipped at adopting new technologies, and coordination, since managers with business degrees may be better at strategy and marketing.

3.3. Entrepreneurship programmes

But what about ‘entrepreneurship education’ specifically? In recent years, there has been a growing number of studies analysing the effects on business performance of providing training in skills that are thought to be of importance for entrepreneurs.

However, the results of these programmes are mixed. In the developing world, business training programmes appear to have had at best only modest effects on business stay-up rates in the short-term perspective on average – and little impact at all on outcomes such as profits and employment (see McKenzie and Woodruff 2014). For example, a randomised evaluation of a Peruvian programme giving business training to female micro-entrepreneurs with the aim of improving basic business practices – such as how to use profits, where to sell, and how to treat clients – finds no measurable effects on employment, business revenue, or profits after one-to-two years (Karlan and Valdivia 2011). The same overall conclusions are found in a recent randomised experiment on business training in Tanzania (Bardasi et al. 2017). Similarly, another evaluation of a similar programme in Sri Lanka found no effects on profits, sales, or capital stock among women who were already running subsistence businesses. Among women who were outside the labour market but interested in starting a business, the training increased the probability of entry and profitability, suggesting that training was effective only among very new owners (de Mel et al. 2014). Another trial in Togo found that traditional business training had no impact on profits, sales, or firm survival, but that a personal-initiative programme, which teaches a proactive mind-set and focuses on behaviour, boosted profits and sales (Campos et al. 2017).

While trials run in the developing world have suffered from various problems that have made them somewhat unreliable (see McKenzie and Woodruff 2014), there is little to suggest that traditional entrepreneurship training on average, as it is currently delivered in these places, works to improve firm success.

However, an important exception concerns training to improve management practices specifically. For example, a Mexican randomised trial provided small
and medium enterprises with one year of management consulting services with the specific aim of improving owner-managers’ managerial skills. Enterprises were matched with one of nine local consulting firms with the specialised services they needed, and the owners met with the consultants 4 hours per week for one year. The results displayed positive effects of the programme on total factor productivity and returns on assets after one year, but no short-term effects on employment, sales, and assets. However, the impact on employment increased year by year – and five years after the intervention there was a sizable positive impact on employment. These effects appear to operate via changes in management practices, especially those related to marketing, financial accounting, and business planning (Bruhn et al. 2018). This highlights the importance of studying how training affects firm success in the medium-term perspective, which most studies do not do – but more generally also highlights the importance of business owners having access to training in management practices such that they can acquire the skills needed to improve.

The idea that training in management can raise firm performance considerably is further supported by the results of an Indian trial, where founders of 100 high-growth technology firms were randomly given advice from other founders using better management practices – more monitoring, targets, and tracking – or advice from other founders using worse management practices, over two days of a business retreat. The findings show that advice from peers using better management practices induced founders to improve their own management practices – and their businesses experienced higher employee retention rates and increased business survival eight months after the retreat (Chatterji et al. 2017). Research from Togo finding positive effects of personal-initiative training on sales and profits also indicate that the adoption of better management practices is a key mechanism (Campos et al. 2017). This further provides evidence that education and training leading to the adoption of better management practices has positive effects on firm performance.

This said, we note that in the developed world there are fewer studies using rigorous designs to evaluate the effects of entrepreneurship education and training on entrepreneurship outcomes. The research that does exist also tends to evaluate programmes at school or university level, rather than specific training courses that may be accessed by prospective or existing business owners. Existing research also often focuses merely on self-employment rather than the type of high-quality entrepreneurship that we seek to identify in this report (see
Existing evidence

Martin et al. 2013). In this sense, effects deriving from the type of education we may expect business owners to go through – training courses that can be combined with full-time work – are less explored in the developed world than in developing countries.

Generally, the few decent studies that do exist generate mixed findings from a business stay-up perspective. In Sweden, Elert et al. (2015) study the long-term effects of entrepreneurship education in upper-secondary school, finding that it increased the long-term probability of starting a firm up to 16 years after graduation – but that it had no impact on firm survival. In Chile, meanwhile, entrepreneurship schooling via business-accelerator programmes appears to raise firm performance and employment (Gonzalez-Uribe and Leatherbee 2018). Yet in America, a large randomised trial offering entrepreneurship training to business owners and prospective business owners finds no effects on pre-existing business survival rates, sales, or employment after sixty months (Fairlie et al. 2015). Similarly, in the UK, a randomised trial run by the Department for Business, Innovation and Skills on the effects of “growth vouchers” – which sought to encourage small businesses to obtain private-sector business advice to help them succeed – found some positive effects on business-planning measures as well as turnover growth after six months, but had no impact on employment (Adams et al. 2016). The evidence on the effects of business training and advice from the developed world is therefore mixed, but then, to the best of our knowledge, there appears to have been no similar types of trials focusing specifically on the type of management practices that evidence from the developing world indicates have positive effects.

Overall, therefore, the evidence does suggest that human capital is an important factor in encouraging entrepreneurial success. Specifically, task-related education appears to be most important and especially training that induces owners to adopt better management practices. In the next section, we provide new evidence on the type of education that is likely to be necessary to increase business survival and success more generally.
4. **New evidence from Europe**

The evidence thus indicates that human capital is important for entrepreneurial success, especially to the extent it improves management practices. To shed more light on the type of training that is likely to be necessary, we provide a new quantitative analysis of the relationship between degree type and firm size, using the OECD’s (2018) PIAAC survey.

PIAAC was created to provide a reliable metric of literacy, numeracy, and problem-solving skills among the populations of OECD and partner countries, and a tool for policymakers seeking to improve their nations’ average skill levels. In the first round, carried out between 2008 and 2013, representative samples of the adult populations in 24 countries and sub-national entities – including England and Northern Ireland – participated, while populations in another nine countries participated in the second round, which was carried out between 2012 and 2016.

4.1. Data

In our analysis, we focus on the 21 European countries and sub-national entities for which there are data available: Austria, Belgium (Flanders), Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, Ireland, Italy, Lithuania, the Netherlands, Norway, Poland, Slovak Republic, Slovenia, Spain, Sweden, and the UK (England and Northern Ireland). Focusing on European economies only allows us to estimate the relative importance of different types of education in broadly similar economies and regulatory environments, which is important given the methodological assumptions outlined in Section 4.2. Table A1 in the Appendix outlines the descriptive statistics of the variables used in the analysis.
4.1.1. **Outcomes**

Apart from sitting the tests, participants in PIAAC answer a questionnaire about their background and labour-market status, which allows us to identify business owners and self-employed people specifically. These respondents also provide information on whether or not they employ anyone and, if so, how many people they employ, in intervals ranging from 1 to 10 people, 11 to 50 people, 51 to 250 people, 251 to 1,000 people, and more than 1,000 people. The ordinal scale therefore ranges from 0 to 5. In Austria and Germany, however, the respondents only indicated whether they employ 1 to 10 people, or more than 10 people. The ordinal scale for this variable therefore ranges from 0 to 2. Both are important indicators of firm success and accordingly we use them as dependent variables in our analysis. Since we are only interested in private entrepreneurship, we exclude respondents who are active in the public sector.\footnote{This applies to only 213 out of 10,580 business owners. Another 92 of them work in the non-profit sector. There were 14 non-respondents to this question. Unsurprisingly, the results are therefore very similar if we include all individuals irrespective of the sector in which they work.}

In addition, we also create binary indicators to measure non-linear effects on firm success. The first indicator takes the value 1 if respondents employ at least one person, and 0 otherwise. This indicator allows us to investigate whether different types of education predict higher/lower likelihood that business owners take this important early step toward becoming high-quality entrepreneurs. As highlighted in Section 2, most small businesses have no employees other than the owner and there is little to suggest that these firms predict higher economic growth. Whether or not business owners employ anyone is therefore an indicator of the probability of whether or not they are likely to become low- or high-impact entrepreneurs in future.

While the above binary indicator measures the probability that business owners take this important early step towards high-quality entrepreneurship, it is not in itself a good indicator of such entrepreneurship. We therefore create a second binary indicator that takes the value 1 if the respondents employ at least 10 people and 0 otherwise. This allows us to study whether or not different types of education among business owners predict a higher/lower likelihood of taking further steps toward becoming a high-impact entrepreneur.

In total, we study 10,580 business owners and self-employed people in 21 European countries when using the ordinal indicator ranging from 0 to 2 as well
as the binary indicators. When analysing the ordinal indicator ranging from 0 and 5, the number of business owners and self-employed people amount to 9,719 across 19 European countries.

4.1.2. **Area of study**

As our principal independent variables, we create indicators for the area of study in which the respondents took their highest qualification: (1) General programmes, (2) Services; (3) Teacher training and education science (“Education”), (4) Humanities, languages, and arts (“Humanities”), (5) Social sciences, business, and law (“Business”), (6) Engineering, manufacturing, and construction (“Engineering”), (7) Agriculture and veterinary sciences (“Agriculture”), (8) Health and welfare (“Health”), and (9) Science, mathematics, and computing (“Science”). These indicators allow us to analyse whether certain degree backgrounds predict firm success more or less than others.

In the analysis, we use “General programmes” as the reference category, which means that the results reflect differences between business owners with degrees in any of the other study areas compared with “General programmes”.

4.1.3. **Control variables**

Of course, even if business owners’ areas of study predict firm success, this may be because they correlate with other observable and unobservable characteristics that in turn also predict firm success. This is not a problem if such characteristics are a result of obtaining a degree in the relevant area of study. For example, if business owners adopt certain policies and practices that increase firm success as a result of having a science degree, this degree would be the fundamental cause behind the effect (while the policies and practices would be mechanisms explaining it). However, if the other characteristics both explain why the business
Human capital and business stay-up owners have a science degree and why they implement the successful policies, the results would be biased.

We seek to minimise this problem by adjusting for a number of important factors: the year respondents started their current business (which ensures that we account for the “liability of newness” discussed in Section 2); respondents’ gender; age; first- and second-generation immigrant status; the number of years spent in the country; the number of people in the respondents’ households (to account for potentially confounding background characteristics); and country-fixed effects (which take into account differences across countries that affect firm success).

In addition, we explicitly adjust for the highest level of formal education that respondents obtained, expressed in eight levels: (1) primary or less, (2) lower secondary, (3) upper secondary, (4) post-secondary, non-tertiary, (5) tertiary – professional degree, (6) Bachelor degree, (7) Master’s degree, and (8) research degree.10 This allows us to take into account that people with certain educational backgrounds are more or less likely to have more or less formal education than others – which may very well affect firm success in and of itself.11

Similarly, we also adjust for respondents’ average PIAAC score in numeracy and literacy.12 As noted in Section 2, these scores pick up both cognitive and non-cognitive skills – such as conscientiousness – which are likely to affect both the area of study as well as the probability of firm success. It is therefore important to hold constant these scores in the analysis.13

4.2. Methodology and assumptions

To study the relationship between business owners’ educational background and the number of employees they hire, we use linear regression models and adjust for all variables discussed in Section 4.1.3. However, it is also important to take

\footnotesize{10 In some countries, there is only an indicator for whether or not respondents have completed a bachelor, masters or research degree. We therefore include a separate indicator for these individuals in the models to ensure they do not bias the results.

11 Results are essentially identical if we also include indicators for the world region in which the respondents obtained their highest qualification.

12 Results are essentially identical if we instead include numeracy and literacy scores separately.

13 As in most surveys, the PIAAC dataset contains some missing values for the control variables. We assign these observations a value of 0 and also create and include dummies for missing values. Similar techniques are used widely in previous research analysing international test-score data (see Hanushek and Woessmann, 2011).}
into account the complex structure of the PIAAC survey. For example, because of the weight of the response burden, individuals often do not answer all of the questions. Instead, total scores are derived from ten ‘plausible values’, which must be aggregated using a specific statistical model.\textsuperscript{14} We take into account the complex structure of the data by employing the method recommended by the OECD (2013), which also weight all individuals using the sample weights provided to ensure that the sample is representative of the underlying population.

Certainly, it is always important to be careful when drawing causal conclusions from these types of analyses. Despite including the controls described in Section 4.1.3, there may, for example, be other omitted characteristics that affect the relationship between the area of study and firm size. Nevertheless, since we are able to adjust for a wide range of variables – including when owners founded their businesses, their absolute educational level, as well as their PIAAC scores – we believe the analysis is still informative of how different types of education predict firm success.

\textsuperscript{14} To adjust for the average PIAAC score, we create ten new plausible values using the mean of the plausible values in numeracy and literacy.
5. Results

In this section, we report the findings from the analysis. Full tables are included in the Appendix. All figures display the mean difference in outcomes between individuals with qualifications in each area of study compared with the reference category ‘General programmes’, once holding constant the other variables discussed in Section 4.1.3.

5.1. The number of employees

Figure 2 displays the results, including all control variables in Section 4.1.3 for the number of employees in 6 categories (0, 1 to 10 people, 11 to 50 people, 51 to 250 people, 251 to 1,000 people, and more than 1,000 people). The bars indicate the difference between the number of employees on the scale between 0 and 6 at firms with business owners with each specific type of qualification, and business owners whose highest qualification was a general programme.

Note: figures in bold indicate a statistically significant difference compared with ‘General programmes’
The results indicate that most types of education have no statistically significant relationship to the number of employees, compared with general programmes, after adjusting for the control variables in the model. The exceptions are the social science, business, and law category ("Business"), which has a relatively strong positive relationship with the number of employees, and the engineering category. Compared with owners who have studied general programmes, owners with qualifications in social sciences, business and law (the "Business" category) score 0.18 points higher on the ordinal scale between 0 and 6. While it is not possible to translate this effect size into an exact number of employees, it amounts to a 0.30 standard deviation increase overall. The relationship between having an engineering qualification and the number of employees is weaker: compared with business owners who have studied general programmes, business owners with qualifications in engineering score 0.06 points higher on the ordinal scale between 0 and 6 (0.10 standard deviations). As displayed in Table A2 in the Appendix, the differences between social sciences, business, and law, and the other categories displayed in Figure 2, are all statistically significant.

Other types of education appear to be negatively or positively correlated with the number of employees hired by business owners, but they are within the margin of error compared to general programmes.

A similar story applies when we analyse the number of employees as three categories – 0, 1 to 10 people, or more than 10 people (i.e. including owners in Austria and Germany). Figure 3 shows the results, which again suggest that owners with qualifications in social science, business, and law (the "Business" category) stand out in terms of the number of employees working for them. Compared with business owners who studied general programmes, business owners with qualifications in social sciences, business and law score 0.16 points higher on the ordinal scale between 0 and 2, an effect size that amounts to 0.28 standard deviations overall. As displayed in Table A2 in the Appendix, the differences between having a qualification in a social science, business or law, and having qualifications in the other educational categories in Figure 3 are also mostly statistically significant.
Again, there is further evidence that business owners with degrees in engineering have more employees working for them than people who have studied general programmes, raising the number of employees by 0.07 points on the ordinal scale between 0 and 6, an effect size that amounts to 0.12 standard deviations overall.

The headline finding thus far is therefore that qualifications in social science, business and law predict firm success – in terms of the number of employees hired – best out of the categories available in PIAAC, with engineering qualifications coming in second.

5.2. The probability of employing at least one person

As highlighted in Section 2, most small businesses have no employees other than the owner – and there is little to suggest that these types of firms are likely to grow. Whether or not business owners employ anyone at all apart from themselves is therefore an indicator of the probability that they will become low- or high-impact entrepreneurs in future. It is therefore important to investigate the relationship between different areas of study and the probability that business owners employ at least one other person than him or herself.
Again, we find that social science, business and law qualifications positively predict firm success in terms of the number of employees. Figure 4 illustrates that such a qualification increases the probability that the business owners employ at least one person by 11 percentage points compared with general programmes. As displayed in Table A2 in the Appendix, the differences between having a qualification in a social science, business or law and having qualifications in the other educational categories in Figure 4, although fewer compared with the estimates in Section 5.1, are statistically significant in the majority of cases.

![Figure 4: The relationship between study area and the probability of employing at least 1 person](image)

Note: figures in bold indicate a statistically significant difference compared with ‘General programmes’

Similarly, there is again evidence that engineering qualifications also raise the probability of employing at least one person, although by a smaller magnitude (5 percentage points) than the social science, business and law (i.e. “Business”) category. In this case, the findings also suggest that health qualifications raise the probability of having at least one employee by 8 percentage points, although this estimate is only just statistically significant.

The estimates for the other programmes are not statistically significantly different from general programmes, although some come closer than in the analysis of the ordinal variables in the previous section.

Overall, we therefore conclude that the type of training obtained through social science, business and law, and engineering, is positively related to business owners’ employing at least one person – so taking an important step from low-
impact to high-impact entrepreneurship. In this case, there are also indications that health qualifications have a positive effect.

5.3. The probability of employing at least 10 people

As highlighted in Section 4.1.1, while the business owner’s area of qualification is an indicator of the probability that business owners will hire at least one person, and so take an important step towards high-quality entrepreneurship, it is not a good indicator of such entrepreneurship per se. We therefore study a higher threshold serving as a proxy for high-impact entrepreneurship specifically: whether or not the business owners employ at least 10 people.

Figure 5 displays the results, which support our previous conclusions: business owners with a background in social science, business or law are more likely to employ at least 10 people compared with business owners whose background are in general programmes. The results indicate that having completed one’s highest qualification in social science, business or law increases the probability of employing at least 10 people by 5 percentage points. Given that the share of business owners employing at least 10 people overall is 4 per cent, this is a sizable effect indeed.

As displayed in Table A2 in the Appendix, the differences between having a qualification social science, business or law and having qualifications in the
other educational categories in Figure 4 are also statistically significant or come close to reaching statistical significance in all cases.

In this case, both the science and engineering categories are also statistically significant, indicating that they raise the probability of employing at least 10 people by 3 and 2 percentage points respectively. The other areas of study do not have a statistically significant relationship with this outcome.

Overall, therefore, the type of training obtained through social science, business and law as well as science and engineering qualifications appears positively related to the probability that business owners employ at least 10 people, which is an important indicator of high-impact entrepreneurship.

5.4. Summary of the findings

Overall, all findings indicate that all areas of study are not equal in terms of stimulating firm success: whereas the training obtained through programmes in business, social science, and law, and in technical areas – especially engineering – appears to increase the number of employees hired by business owners compared with general programmes, education in other subject areas does not seem to be an equally reliable predictor of such success.

The headline finding is that programmes in business, social science, and law predict firm success best out of the categories available in PIAAC, with qualifications in technical subjects coming in second. While it is not possible to pinpoint the exact mechanism explaining these findings, research discussed in Section 3 indicates that managers and owners with a business education are more likely to utilise management practices that in turn predict entrepreneurial success. We also note that the positive impact of social science qualifications concurs with recent research suggesting that political leaders with a degree in economics improve their countries’ growth rates compared with leaders with other types of education (Brown 2017). Overall, therefore, it is plausible that people with qualifications in social science (especially economics), business and law obtain an education that is simply more relevant for prospective business owners than training in many other fields. Meanwhile, the fact that business owners with more technical degrees come in second may depend on their superior ability to adopt new technologies, in support of Queiro’s (2016) findings.
6. Raising human capital through relevant adult education and training

Our research therefore suggests that relevant training for business owners is likely to be important for ensuring higher rates of firm success. While some may obtain such training through full-time formal education, many are more likely to obtain it through various forms of adult education and training. This is simply because such education is often designed to be more flexible in terms of time commitment than full-time formal education, which is important given the time pressures involved in running a business.

To investigate the extent to which business owners engage in adult education and training of relevance for their work, we calculated the percentage of owners who participate in job-related adult education across countries participating in PIAAC. While we do not know the content of the education they underwent, this at least gives us an indication of the capacity for raising owner participation in adult education and training in the different countries.

Figure 6 on the following page shows large differences in the take up of job-related adult education among business owners in the 33 countries that have participated in PIAAC, ranging from 7 per cent in Russia to 54 per cent in Finland.15 In Europe, Greece has the lowest share of business owners who participate in some form of job-related adult education, while the United Kingdom is in the middle of the pack. But even in Finland, the leading nation in this regard, 46 per cent of business owners do not engage in any job-related adult education. Stimulating more business owners to engage in the right sort of learning could therefore be a

---

15 The United Kingdom refers to England and Northern Ireland and Belgium refers to Flanders only.
promising avenue for raising their work-related human capital in most countries, in order to improve business stay-up rates and entrepreneurial performance more generally.

**Figure 6**

The share of business owners engaging in job-related adult education and training

Source: author’s calculations using PIAAC data obtained from the OECD (2018)
7. Conclusion and policy recommendations

In the last decades, governments worldwide have used different policy tools to increase entrepreneurship rates in their countries. While stimulating new enterprise is a worthwhile goal, it is also important to devise policies to help improve entrepreneurial quality.

This report has highlighted the priority that governments should place on investment in education in general terms, and specifically at the further and higher educational levels and beyond, if they are to stimulate and support high-quality entrepreneurship, employment, and a prosperous economy.

The findings are important for informing students’ subject choices at further and higher education in that they indicate which subject areas are likely to give them the knowledge and skills they need for success in the enterprise economy.

The main focus of the report, however, is the importance of investing in human capital for business owners and managers. Based on our reading of the empirical literature and our own findings from PIAAC, the most promising approaches appear to focus on task-related training, in both an operational and content-specific sense. To maximise the probability of firm success, owners must acquire the operational skills of organisation and management, but must also keep up-to-date with the latest developments in the field in which they operate. Training in management skills is likely to be especially important. Good management practices – and education improving such practices – have been proven to predict entrepreneurial success across a wide range of sectors.

As the most probable avenue for such training lies in adult job- or career-related learning initiatives rather than formal schooling, it is important that support be given specifically to such initiatives. To do so, we propose the following general approaches:
1. Provide tax relief for business owners to invest in adult job- or career-related learning initiatives.

The exact mechanism to provide such relief will vary across countries, but could be designed as tax credits. The goal should be to make it equally attractive to invest in business owners’ human capital via such training programmes as it is to invest in physical capital.

2. Identify what works by sponsoring randomised trials of promising training approaches.

As the paper has highlighted, one of the most promising training approaches to improving entrepreneurial success appears to work via improved management practices. However, such training does not necessarily have to be focused on business practices as such; some research identified in this paper finds that personal-initiative training, which teaches a proactive mind-set and focuses on behaviour, has the potential to improve business success via management practices as well. There are likely important complementary approaches between straightforward training in management practices and other approaches.

Since we still know little about the relative effectiveness of different training approaches, we propose that governments should invest in randomised trials to test different approaches brought to them by different stakeholders. The approach could be similar to the Education Endowment Foundation, which was set up to run trials in order to find out what works to improve pupil performance.¹⁶

While investment in human capital is by no means the only measure of importance to increasing entrepreneurial success, it is likely to be a crucial ingredient in this endeavour. To maximise the probability of entrepreneurial success, owners must learn the operational skills of organisation and management, but also keep up-to-date with the latest development in the field in which they operate. Stimulating take-up of such training, and providing research into what works most efficiently in this sense are therefore important responsibilities for governments.

¹⁶ See https://educationendowmentfoundation.org.uk/about/history/.
References


### Table A1. Descriptive statistics

<table>
<thead>
<tr>
<th>Variable</th>
<th>Average</th>
<th>SD</th>
<th>Min</th>
<th>Max</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of employees (6 categories)</td>
<td>0.38</td>
<td>0.59</td>
<td>0</td>
<td>5</td>
</tr>
<tr>
<td>Number of employees (3 categories)</td>
<td>0.40</td>
<td>0.57</td>
<td>0</td>
<td>2</td>
</tr>
<tr>
<td>Employ at least 1 person</td>
<td>0.36</td>
<td>0.48</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Employ at least 10 people</td>
<td>0.04</td>
<td>0.20</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>General programmes</td>
<td>0.07</td>
<td>0.26</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Services</td>
<td>0.07</td>
<td>0.25</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Humanities</td>
<td>0.08</td>
<td>0.27</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Business</td>
<td>0.16</td>
<td>0.36</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Education</td>
<td>0.02</td>
<td>0.14</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Agriculture</td>
<td>0.06</td>
<td>0.24</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Health</td>
<td>0.06</td>
<td>0.23</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Science</td>
<td>0.06</td>
<td>0.23</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Engineering</td>
<td>0.21</td>
<td>0.41</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Year of starting business</td>
<td>1998</td>
<td>11</td>
<td>1959</td>
<td>2014</td>
</tr>
<tr>
<td>Woman</td>
<td>0.32</td>
<td>0.47</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Age</td>
<td>44.19</td>
<td>10.99</td>
<td>16</td>
<td>65</td>
</tr>
<tr>
<td>Number of people in the household</td>
<td>3.12</td>
<td>1.32</td>
<td>1</td>
<td>6</td>
</tr>
<tr>
<td>First-generation immigrant</td>
<td>0.09</td>
<td>0.29</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Second-generation immigrant</td>
<td>0.02</td>
<td>0.15</td>
<td>0</td>
<td>1</td>
</tr>
<tr>
<td>Number of years spent in the country</td>
<td>42.17</td>
<td>13.18</td>
<td>0</td>
<td>65</td>
</tr>
<tr>
<td>Educational level (8 categories)</td>
<td>3.52</td>
<td>1.76</td>
<td>1</td>
<td>8</td>
</tr>
<tr>
<td>Average PIAAC result</td>
<td>269</td>
<td>46</td>
<td>36</td>
<td>426</td>
</tr>
</tbody>
</table>

Note: all data are weighted by sampling probabilities using the PIAAC sample weights. Out of the 10,580 business owners included in the analysis, only observations without missing values are used to calculate the descriptive statistics for each variable.
Table A2. The relationship between business owners’ study area and firm size

<table>
<thead>
<tr>
<th>Study Area</th>
<th>Employee Categories</th>
<th>Employment Categories</th>
<th>P-values</th>
<th>p-values</th>
</tr>
</thead>
<tbody>
<tr>
<td>Services</td>
<td>0.06</td>
<td>0.04</td>
<td>0.04</td>
<td>0.00</td>
</tr>
<tr>
<td>Humanities</td>
<td>-0.05</td>
<td>-0.04</td>
<td>-0.05</td>
<td>0.00</td>
</tr>
<tr>
<td>Business</td>
<td>0.18***</td>
<td>0.16***</td>
<td>0.11***</td>
<td>0.05***</td>
</tr>
<tr>
<td>Education</td>
<td>0.03</td>
<td>0.05</td>
<td>0.03</td>
<td>0.02</td>
</tr>
<tr>
<td>Agriculture</td>
<td>0.01</td>
<td>0.02</td>
<td>0.03</td>
<td>-0.01</td>
</tr>
<tr>
<td>Health</td>
<td>0.00</td>
<td>0.09</td>
<td>0.08*</td>
<td>0.02</td>
</tr>
<tr>
<td>Science</td>
<td>0.07</td>
<td>0.05</td>
<td>0.02</td>
<td>0.03*</td>
</tr>
<tr>
<td>Engineering</td>
<td>0.06**</td>
<td>0.07**</td>
<td>0.05**</td>
<td>0.02**</td>
</tr>
</tbody>
</table>

Country effects: Yes
Controls: Yes

R2: 0.08
n: 9,719

Note: Significance levels: *p<0.10; **p<0.05; ***p<0.01. Standard errors computed using the jackknife replicate procedure in parentheses. The controls include: gender; age; the year respondents started their current business; first- and second-generation immigrant status; the number of years spent in the country; the number of people in the respondents’ households; educational level (8 categories); the average numeracy and literacy score in PIAAC; and missing dummies.
In recent decades, governments worldwide have employed an array of different policy tools to try to increase start-up rates in their countries, but relatively little attention has been paid to how to support ‘business stay-up’. In that it is among the fastest growing small businesses that employment growth, innovation and productivity gains are strongest, this lag in the progress of entrepreneurship policy should give us cause for concern.

Of those approaches to supporting business sustainability that have been tried, efforts to improve management practices have shown promise. This report adds to a growing body of evidence in this area, new research supporting the importance of human capital to entrepreneurial outcomes.

Author Gabriel Heller Sahlgren’s research substantiates a relationship between business owners’ specific areas of qualification and the growth of their enterprise. Moreover, and more importantly, he further finds that not all areas of qualification are equal in terms of stimulating success. The training obtained through programmes in business, social science, and law, and in technical areas, such as engineering, appear to lead to employee growth – whereas programmes relating to other subject areas do not.

Accordingly the author argues that governments should seek ways to incentivise training in high impact areas, and in management skills specifically. The most promising approaches, he finds, appear to focus on task-related training, in both an operational and content-specific sense. To maximise the probability of firm success, owners must therefore learn the operational skills of organisation and management, while at the same time keep up-to-date with the latest developments in the field in which they operate.