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Assessment of Framework Conditions for the Creation and Growth of Firms in Europe

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Title Assessment of Framework Conditions for the Creation and Growth of Firms in Europe

Abstract

This report contributes to a better understanding of the framework conditions that are conducive to the emergence and the growth of entrepreneurial activities in Europe. It takes into account a broad variety of framework conditions, including entrepreneurial culture, access to human capital, support initiatives for knowledge creation and networking, market conditions, availability of sufficient and appropriate finance, prevailing business regulations and the quality of the supporting infrastructure. For each of these framework conditions, the prevailing literature identifies the underlying components that affect the creation and growth of firms respectively. A set of two composite indicators – i.e. the Entrepreneurship and Scale-up Indices (ESIS) – have been constructed to facilitate the comparison across Member States. As such, this report provides a working tool to monitor and benchmark EU Member States in the creation of a business-friendly environment that can foster both the creation and the growth trajectories of firms.

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Foreword

This report was prepared in the context of the three-year research project on European Innovation Policies for the Digital Shift ([EURIPIDIS](#)), jointly launched in 2013 by JRC and [DG CONNECT](#) of the European Commission. EURIPIDIS aims to improve understanding of innovation in the ICT sector and of ICT-enabled innovation in the rest of the economy.

The project's objective is to provide evidence-based support to the policies, instruments and measurement needs of DG CONNECT for enhancing ICT innovation and entrepreneurship in Europe, in the context of the Digital Single Market for Europe, the Startup Europe Initiative and the ICT priority of Horizon 2020.

EURIPIDIS aims:

- to better understand how ICT innovation works, at the level of actors such as companies, and also of the ICT "innovation system" in the EU;
- to assess the EU's current ICT innovation performance, by attempting to measure ICT innovation in Europe and by measuring the impact of existing policies and instruments (such as FP7 and Horizon 2020); and
- to explore and suggest how policy makers could make ICT innovation in the EU work better.

This report contributes to a better understanding of the framework conditions that are conducive to the emergence and growth of firms in Europe. It takes into account a broad variety of framework conditions, including entrepreneurial culture, access to human capital, support initiatives for knowledge creation and networking, market conditions, availability of sufficient and appropriate finance, prevailing business regulations and the quality of supporting infrastructure.

For each of these framework conditions, the underlying components that affect respectively the creation and growth of firms are identified in the prevailing entrepreneurial literature. A set of two composite indicators –i.e. the Entrepreneurship and Scale-up Indices (ESIS) – are constructed to facilitate benchmarking across Member States. As such, ESIS provides a working tool to monitor and benchmark EU Member States in creating a business-friendly environment that can foster both the creation of firms and their growth trajectories.

Acknowledgements

This analysis was produced in the context of the European Innovation Policies for the Digital Shift ([EURIPIDIS](#)) project, jointly launched in 2013 by JRC and [DG CONNECT](#) of the European Commission. The purpose of the EURIPIDIS project is to provide evidence-based support to the policies, instruments and measurement needs of [DG CONNECT](#) for enhancing ICT innovation in Europe, as part of the Digital Agenda for Europe and of the ICT priority of [Horizon 2020](#), and for promoting entrepreneurship in Europe through the Startup Europe Initiative.

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Executive summary

Entrepreneurship is a major driver of economic development as it provides the building blocks for job creation and innovation, leading to substantial improvement in human welfare. Therefore, EU-level policy makers have deemed it essential to improve the climate for entrepreneurs and encourage the growth of firms. This report aims to measure and assess those conditions at national level that provide fertile ground for the creation and growth of entrepreneurial activity in Europe.

In general, framework conditions for both the creation and growth of firms tend to be similar in terms of how favourable they are: i.e. countries with (less) favourable framework conditions for the creation of firms also have (less) favourable conditions for the growth of firms. Based on the analyses of this report, countries are classified in four groups, conditional on the quality of framework conditions that they each provide for the creation and growth of firms. The characteristics of the framework conditions in each group are presented below, together with examples of countries belonging to these groups. As the framework conditions that favour the creation and growth of firms are analysed separately, some countries may not belong to the same group for both categories. Hence, some countries may have excellent framework conditions for the creation of firms, but provide lower quality framework conditions for the growth of firms, leaving challenges for improvement to the latter category. Unless explicitly stated otherwise, in this executive summary we highlight only those countries that share a common group.

Excellent framework conditions

Countries with excellent framework conditions outperform all the other groups in all dimensions. The favourable framework conditions conducive to the creation and growth of firms are based on high levels of **entrepreneurial culture**, ease of access to appropriate **financial instruments** and access to outstanding **human capital** resulting from the availability of appropriate job occupations and the provision of continuous staff training.

Countries belonging to this group: Scandinavian countries, the Netherlands and the United Kingdom.

Very good framework conditions

Countries with very good framework conditions for the creation of firms have a well-developed **physical and logistics infrastructure** and promising **market conditions**. The framework conditions that favour the growth of firms in this group are strong **digital infrastructure** and broad **market expansion** possibilities through cross-border e-commerce and foreign direct investments. The main difference with the previous group is a more pronounced difficulty in finding appropriate financial resources, particularly for the creation of firms.

Countries belonging to this group: Belgium, Germany, Estonia, France and Austria.

Good framework conditions

Countries with good framework conditions score well on regulations for starting new businesses and relatively well on access to human capital and market conditions. However, these countries provide environments that are **less business-friendly** due to their **low levels of entrepreneurial culture** and particularly weak investments and IPR initiatives to support knowledge creation. Though these countries have good networking conditions to support the growth of firms, this advantage is completely counteracted by weaker scores in all other dimensions.

Countries belonging to this group: Portugal, Latvia, Spain, Lithuania, Slovenia, Hungary and the Czech Republic.

Fair framework conditions

The scores of countries with fair framework conditions are outdone in almost all dimensions by the other groups. These countries are relatively strong in business-friendly regulations that favour the creation of firms and close to the group of countries with good framework conditions in terms of entrepreneurial culture and market conditions. However, much remains to be done to enhance their access to financial and human resources and to build up their support for knowledge creation. While the levels of access to finance and regulations that favour the growth of firms equal - or even exceed - those of the group with good framework conditions, countries with fair framework conditions lag behind in all other dimensions. Hence, these countries still face considerable challenges in creating a business context which enhances the growth potential of firms.

Countries with fair framework conditions for the creation of firms: Slovakia, Greece, Malta and Croatia.

Countries with fair framework conditions for the growth of firms: Poland, Romania, Italy and Bulgaria.

Country benchmarking analyses reveal the diversity of framework conditions across countries

Country benchmarks are reported for the underlying framework conditions that are the subject of this report. These analyses reveal the strength and weaknesses of each country as regards the conditions for the creation and growth of firms and highlight the diversity of framework conditions within and across country groups. This exercise provides interesting insights and examples of how each country could improve. Although Denmark and the Netherlands have excellent framework conditions for the creation of firms, they are lagging behind other countries in the group in terms of access to finance. Other countries such as Germany and Austria outperform their group members as regards market conditions and knowledge creation, but face greater challenges to improve the regulation and financial infrastructures for firm creation compared to their group counterparts. Similar diversity patterns can be observed for the framework conditions for firm growth. Despite being classified in the same group, Belgium and Estonia have different framework conditions. Belgium has the best score for access to human capital, but lags behind in terms of regulations favouring firm growth, while the opposite is true for Estonia.

There is a strong correlation between a country's level of development and framework conditions for entrepreneurial activity, the exception being Estonia.

The results show a compelling correspondence between a country's geographical location, its level of development and the framework conditions it provides for the creation and growth of firms. Countries with excellent framework conditions are Northern and some Western European countries, including Scandinavia. Countries with very good framework conditions are concentrated in Western Europe and include Belgium, France, Luxembourg, Germany and Austria. A notable exception to this geographical location is Estonia. It has very good framework conditions which favour both the creation and growth of firms, and scores considerably higher than any other Eastern European and some Western European countries. Estonia's high score on framework conditions for stimulating the creation of firms is mainly due to its high levels of entrepreneurial culture, access to human and financial resources and excellent regulations. Estonia's

favourable framework conditions for firm growth are mainly driven by availability of human capital, networking opportunities and the regulatory framework.

Methodology

In order to assess framework conditions for the creation and growth of firms in Europe, a set of two composite indicators has been created, called the Entrepreneurship and Scale-up Indices (ESIS). While the first index captures the conditions that favour the creation of business ventures, the latter addresses those that favour the growth of firms. Each index covers seven framework conditions:

- Culture and institutions,
- Access to human capital,
- Creation of knowledge and networking,
- Market conditions,
- Access to finance,
- Tax and regulations, and
- Infrastructure and support.

For each of these framework conditions, the underlying components that affect respectively the creation and growth of firms have been identified in the prevailing entrepreneurial literature. These components are empirically measured by both the Entrepreneurship and the Scale-up Indices in terms of 20 and 25 indicators respectively. These indicators come mainly from publicly-available data sources that are annually updated.¹

Based on the ESIS outcome, Member States are classified into four groups according to how they score in terms of the quality of the conditions they offer. The appeal of classifying EU Member States in this way is that it allows us to benchmark countries with their immediate peers (i.e. other countries with similar scores). In addition, comparisons across two contiguous groups help to define reasonable targets for the improvement of framework conditions. For each group, ESIS identifies those framework conditions that could receive more support from public governance so that countries can achieve the scores of the group immediately above. As such, ESIS proposes realistic policy actions and does not suggest that all Member States should target the long-term achievements of the highest-scoring group.

¹ For the construction of ESIS, more than 100 indicators have been considered as candidate indicators, but many of them have eventually not been considered due to integrity reasons.

1 Introduction

Entrepreneurship is a major driver of economic development as it provides the building blocks for job creation and innovation, leading to a substantial improvement in human welfare. Over the last few decades, an increasing number of studies have aimed to offer a better understanding of the drivers of entrepreneurial activity in Europe. The most recent employ a holistic approach to entrepreneurship based on the argument that entrepreneurship is not an isolated activity but is embedded in a local context. These studies advance the notion of entrepreneurship ecosystems. Acs et al. (2014) defined entrepreneurial ecosystems as “a dynamic, institutionally-embedded interaction between entrepreneurial attitudes, ability and aspirations, by individuals, which drives the allocation of resources through the creation and operation of new ventures”. Along the same lines, Audretsch and Belitski (2016) defined entrepreneurship as “a dynamic community of inter-dependent actors (entrepreneurs, suppliers, buyer, government, etc.) and system-level institutional, informational and socioeconomic contexts”.

The myriad of institutional, informational and socio-economic factors that determine the local context in which entrepreneurship takes place is commonly referred to as the framework conditions for entrepreneurial ecosystems. Although slightly different denominations have been used to define these framework conditions, they generally encompass the following domains: culture, creation of knowledge, market conditions, access to finance, regulations and support. Given that most of these aspects are affected by or regulated within territorial boundaries, entrepreneurial ecosystems are geographically bounded.

Multiple empirical studies have analysed entrepreneurship ecosystems at various geographical levels. Often cited approaches to measuring and understanding the emergence of entrepreneurial activity at the country level were developed by the Entrepreneurship Indicators Programme (EIP) of the OECD (2011, 2013) and the Global Entrepreneurship Monitor (GEM) (Kelley, Singer, & Herrington, 2015). Recently, analyses have concentrated on more fine-grained geographical levels (i.e. regions and cities) and specific entrepreneurial activities such as information and communication technologies (e.g. NESTA, 2015). We refer to Bogdanowicz (2015) for a comprehensive overview of empirical studies on entrepreneurship ecosystems. To facilitate the comparison of ecosystems across geographical dimensions, the empirical data in these studies is often aggregated in the form of entrepreneurship indices. Generally, empirical studies analysing entrepreneurship ecosystems focus on three dimensions: 1) the determinants of entrepreneurship (input measures or framework conditions), 2) entrepreneurship performance (i.e. output measures which track the emergence of new business ventures), and 3) the impact of entrepreneurship (measuring the effects of entrepreneurship on the economy).

Until recently, empirical studies analysing entrepreneurial ecosystems were primarily focused on understanding the emergence of entrepreneurial activity. Recent empirical evidence on entrepreneurial activity, however, has suggested that there is a need to widen the focus to include the identification, understanding and promotion of firms that contribute the most to economic development. This shift in prioritization was induced by wide recognition that only a small number of firms - commonly denoted as high-growth or scale-up firms - contribute the vast majority of jobs created (Henrekson & Johansson, 2010). Empirical evidence for the United Kingdom, for instance, showed that only a very small proportion of businesses (i.e. 6%) which employed more than 10 employees accounted for 50% of the jobs created in the UK (Bravo-Biosca & Westlake, 2009). Hence, there is a strong need for a policy support instrument which can provide empirical evidence about the conditions that favour the creation of business ventures and especially the development of high-growth or scale-up firms.

The aim of this report is to meet this current need. It develops and applies a methodology to empirically assess framework conditions that support entrepreneurs in reaching the different milestones in their entrepreneurial life-cycle, e.g. creating a

company and then scaling it up. It benchmarks European countries according to the conditions they provide for the creation and growth of companies. This exercise is done with two newly-created composite indicators – i.e. the Entrepreneurship and Scale-up Indices (ESIS) – which allow to empirically assess the strengths and weaknesses of entrepreneurial ecosystems at EU Member State level.

This assessment of framework conditions for the creation and growth of firms in Europe contributes to a better understanding of entrepreneurial ecosystems in individual countries in different ways. First, it expands the existing entrepreneurship ecosystems at country level with milestone achievements in the entrepreneurial life-cycle, i.e. the creation and growth of firms. Hence, it provides a holistic entrepreneurial framework that not only accounts for the emergence of entrepreneurial activity but also looks at the growth trajectories of firms. Second, building on the entrepreneurial literature it targets and assesses the relevant components of each framework condition that affect the entrepreneurial milestones of entrepreneurship creation and growth respectively. Third, the conceptual model presented in Section 2 is constructed as a grid that facilitates the identification of existing policies that target framework conditions for the different entrepreneurial milestones. In addition, this model allows to identify which framework conditions and entrepreneurial milestones are not sufficiently developed. Hence, it can serve as an effective tool to outline future challenges for entrepreneurship policies in Europe and the EU Member States.

The remainder of the report is structured as follows:

- Section 2 details the concept behind the model to assess framework conditions for the creation and growth of firms and the principles behind ESIS.
- Section 3 benchmarks the European countries in terms of framework conditions for the creation and growth of firms.
- Sections 4 and 5 explain the EU Member States' scores on ESIS by highlighting the underlying elements of the framework conditions that are conducive for the creation and growth of firms.
- Section 6 provides an overview of the methodological steps used to construct ESIS as defined by the OECD/JRC Handbook (OECD & JRC, 2008).
- Section 7 provides an in-depth analysis of the framework conditions that covered by this report and presents the different indicators that empirically feed ESIS.
- The statistical methodology for the construction of ESIS is explained in Section 8.
- Finally, Section 9 summarises the main lessons learned from this pilot edition of ESIS.

2 Conceptual model for the assessment of framework conditions for the creation and growth of firms

Entrepreneurial activities and growth of companies are deeply affected by the environment in which they take place. However, the institutional, informational and socio-economic factors that determine this environment – commonly called framework conditions – affect firms in different ways, depending on each firm’s stage of maturity. This section highlights the different concepts behind the emergence and growth of firms, which serve as building blocks for the construction of the Entrepreneurship and Scale-up Indices (ESIS). ESIS is a formal tool for the assessment of framework conditions for the creation and growth of firms at country level. First, it defines the two key milestones and outcomes that entrepreneurs aim to achieve during the entrepreneurial life-cycle: creation and growth (Kelley et al., 2015; Levie & Lichtenstein, 2010; WEF, 2014). Second, it provides an overview of the framework conditions that differently affect the achievement of these outcomes. How and in which components the framework conditions differ in their impact on the two entrepreneurial outcomes is further detailed in Section 7. Third, it describes relevant policy actions which could foster the creation and growth of entrepreneurial activity.

2.1 Entrepreneurial milestones and outcomes

The milestones and outcomes that reflect the key steps of an entrepreneurial journey are presented in Figure 1. All entrepreneurial journeys originate from the recognition of an opportunity. To pursue this opportunity, prospective entrepreneurs have to take action. As the future outcome of this action is highly uncertain, only a few of the individuals that recognise an opportunity actually become entrepreneurs and achieve the first milestone and outcome of the entrepreneurial ecosystem: i.e. the **creation of a start-up**. At this stage, it is essential that they develop a scalable product or service that gives the firm a competitive advantage on the market, allowing the firm to survive.

The second milestone is **growth**. This milestone has attracted considerable attention in recent years with the wide recognition that only the few firms that achieve this milestone are responsible for most of the wealth creation. These firms are typically referred to as high-growth firms or **scale-up firms** (Coutu, 2014).

Figure 1: Entrepreneurial milestones and outcomes



2.2 Framework conditions

The selection of framework conditions for each stage of entrepreneurial activity is guided by a series of previous studies which deal with the drivers of creation and growth of firms (Ardagna & Lusardi, 2010; Isenberg, 2011; Mason & Brown, 2014). We distinguish seven framework conditions in line with those used in other measurement frameworks (Audretsch & Belitski, 2016; OECD, 2013):

- Culture and institutions,
- Access to human capital,

- Creation of knowledge and networking,
- Market conditions,
- Access to finance,
- Tax and regulations and
- Infrastructure and support.

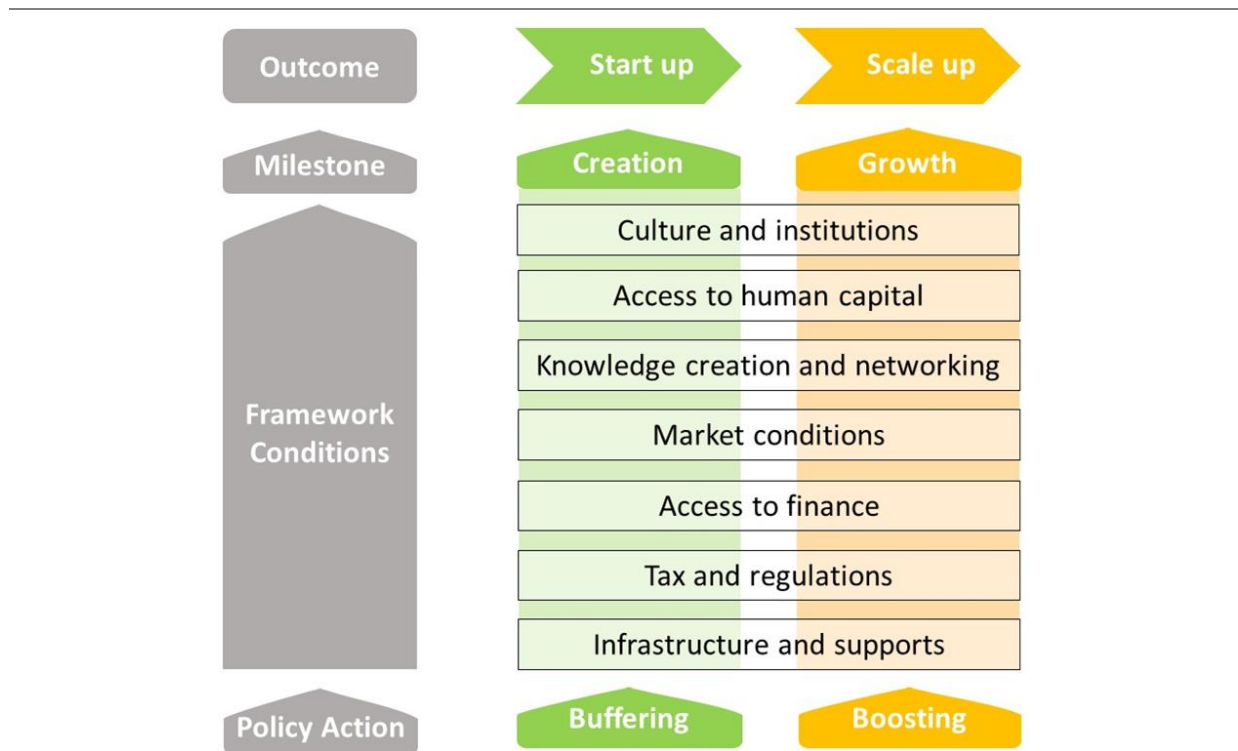
2.3 Policy actions

Concerning the policy actions, we follow the conceptual model of Autio and Ranniko (2016) and distinguish two types of policy in the entrepreneurial life-cycle: **buffering and boosting**. While the first policy activity aims to increase the creation of new organisations, the latter focuses on the organizational growth of businesses. The theoretical framework presented in Figure 2 highlights the heterogeneity of framework and policy conditions for the different milestones.

The rationale behind **buffering** emerges from a resource-based perspective in which firms are seen as resource-constrained entities. Buffering policy aims to create adequate conditions for the provision of vital resources in order to lessen the firm's dependency on external providers. Resource endowment is particularly salient and vital during the creation process to ensure that start-ups "do not run out fuel". Public support through buffering can include seed-stage access to financial capital, low-cost office space, tax deductions, and initiatives to lower the regulatory burden of establishing new firms, among others.

The second public policy relates to **boosting** of organizational capacities for growth. It can take the form of public support which emphasizes growth motivation and encourages firms to achieve milestones towards growth (Autio, Kronlund, & Kovalainen, 2007). Public support of this kind is specifically suited to the growth process of scale-up firms and encourages them in their pursuit of market expansion and economic growth.

Figure 2: Theoretical framework



Note: The policy actions indicated in the model are inspired by the literature on public sponsorship (Autio and Ranniko, 2016).

3 Entrepreneurship and scale-up index

This section benchmarks EU Member States in their provision of the framework conditions that encourage the creation and growth of entrepreneurial activities as measured by ESIS. Both indices take values between 0 and 10. In both the Entrepreneurship and Scale-up indices, **Member States are categorised in four groups** according to the following criteria:

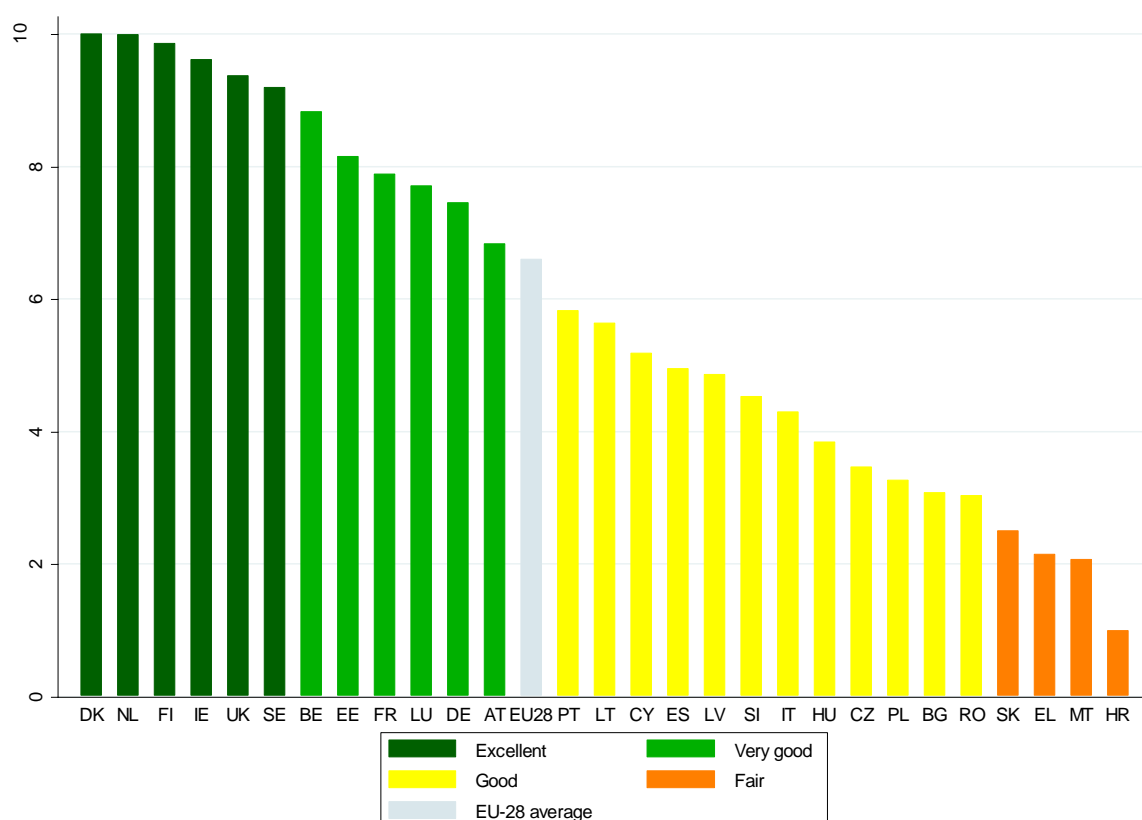
- **Excellent framework conditions:** the first group identifies the Member States with the most favourable framework conditions, exhibiting index scores above 9;
- **Very good framework conditions:** the second group includes Member States with very good favourable framework conditions, having an index score above the EU average but below 9;
- **Good framework conditions:** the third group includes Member States with good framework conditions, with index scores below the EU average but above 3;
- **Fair framework conditions:** the fourth group identifies Member States with fair framework conditions, recording index scores well below the EU average, i.e. less than 3.

The appeal of classifying EU Member States into groups is that it allows to benchmark countries with their immediate peers (i.e. other countries within the same group). In addition, comparisons across two contiguous groups help to define realistic targets for the improvement of framework conditions. Hence, countries with for instance fair framework conditions should first aim to improve the quality of framework conditions up to the level of the "good framework conditions" group, before aiming for the long-term achievements of the excellent group.

3.1 Entrepreneurship index

The benchmark of EU Member States on the Entrepreneurship index is presented in Figure 3. The results show a compelling correspondence between geographical location and index scores. Countries with excellent framework conditions for the creation of firms tend to be Northern and Western European countries, including the Scandinavian countries (Denmark, Finland, Sweden), the Netherlands, the United Kingdom and Ireland. The next group of countries i.e. with very good framework conditions, are concentrated in Western Europe, and include Belgium, France, Luxembourg, Germany and Austria. A notable exception to this geographical location is Estonia. Ranked eighth on the index, Estonia performs considerably better than the other countries in Eastern Europe. Most of the Eastern and Southern European countries are allocated to the country group with good framework conditions. This group includes Portugal, Lithuania, Cyprus, Spain, Latvia, Slovenia, Italy, Hungary, the Czech Republic, Poland, Bulgaria and Romania. The fourth group exhibiting fair framework conditions consists of Slovakia, Greece, Malta and Croatia.

Figure 3: EU Member States benchmark on the Entrepreneurship index



Note: The figure presents the ranking of EU Member States by their score on Entrepreneurship index measuring framework conditions for firm creation at country level. Country groups are identified based on their scores: excellent (above 9), very good (above EU average but below 9), good (below EU average but above 3), fair (below 3).

Calculations: EC JRC.

In order to better understand the patterns behind the index scores, Figure 4 presents a comparison of the average scores for the seven framework conditions across the different country groups. The following conclusions can be drawn from this comparative exercise:

Countries with excellent framework conditions outperform all the other groups in all dimensions. The excellent framework conditions conducive to the creation of firms are particularly driven by high levels of the entrepreneurial culture, ease of access to appropriate financial instruments and outstanding access to human capital and the provision of continuous staff training.

Countries with very good framework conditions for the creation of firms have a well-developed physical and logistics infrastructure and promising market conditions. The main difference with the previous group is a more pronounced difficulty in finding appropriate financial resources during the first steps of the entrepreneurial life-cycle.

Countries with good framework conditions score well on regulations for starting up new businesses and perform relatively well in access to human capital and market conditions. However, the environment for businesses in these countries is poor, due to low levels of entrepreneurial culture and particularly weak investments and IPR initiatives to support knowledge creation.

Countries with fair framework conditions for firm creation are outperformed on almost all dimensions by the other groups. These countries are, however, relatively strong in business-friendly regulations and close to the previous country group in terms of

entrepreneurial culture and market conditions. Nonetheless, much remains to be done to enhance their access to financial and human resources and to build up the support they give for knowledge creation.

Figure 4: Framework conditions per country group for the Entrepreneurship index

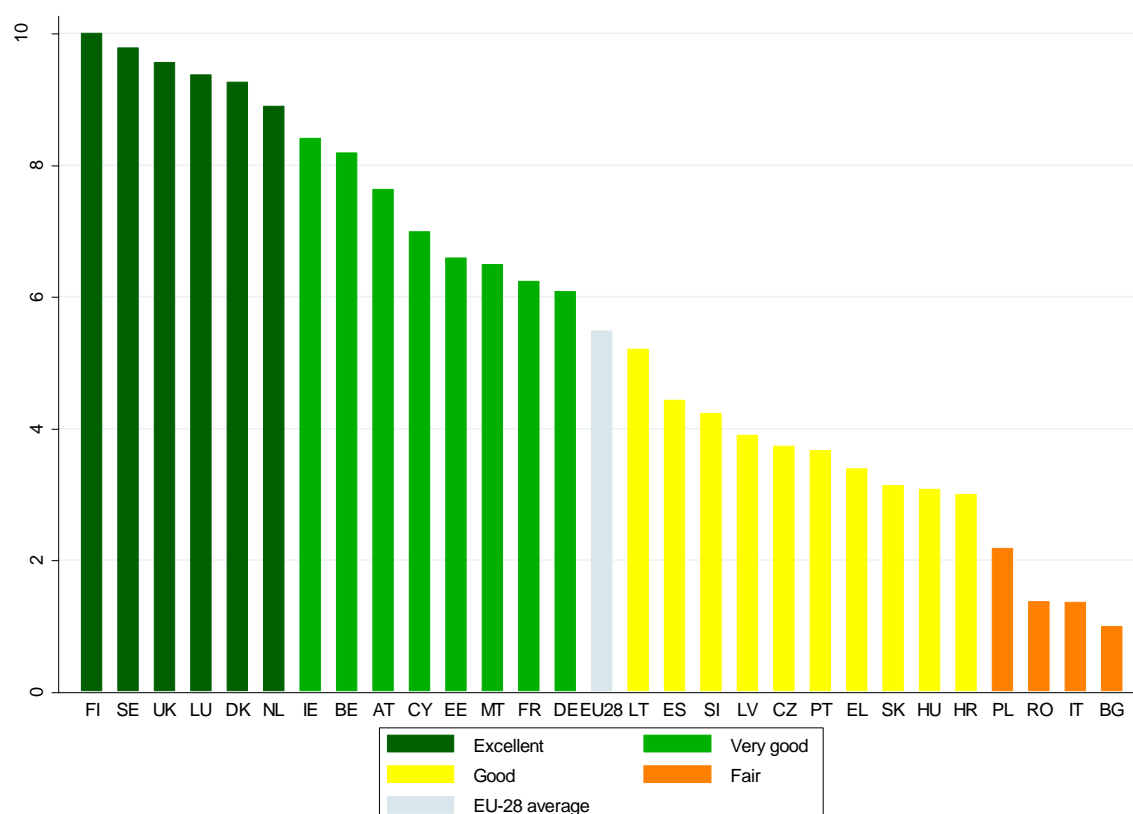


Note: The figure presents the average score of framework conditions per country group on the Entrepreneurship index. Country groups are identified based on their scores: excellent (above 9), very good (above EU average but below 9), good (below EU average but above 3), fair (below 3). Calculations: EC JRC.

3.2 Scale-up index

The scores of the EU Member States on the Scale-up index are presented in Figure 5. Similar geographical location patterns to the Entrepreneurship index can be observed across the different groups. Countries with excellent framework conditions for firm growth consist of Scandinavian and Northern European countries. The top-3 countries are Finland, Sweden and the United Kingdom. Notably, Luxembourg, one of the top countries on the Scale-up index has less favourable framework conditions for the creation of firms. The next group of countries with very good framework conditions includes the remaining Western European countries, with exception of Estonia, Malta and Cyprus. As with the Entrepreneurship index, the country group with good framework conditions is populated by Southern and Eastern European countries. Countries at the lowest end of the index are Poland, Romania, Italy and Bulgaria.

Figure 5: EU Member States benchmark on the Scale-up index



Note: The figure presents the ranking of EU Member States by their score on Scale-up index measuring framework conditions for firm growth at country level. Country groups are identified based on their scores: excellent (above 9), very good (above EU average but below 9), good (below EU average but above 3), fair (below 3).

Calculations: EC JRC.

In order to better understand the patterns behind the index scores, Figure 6 presents the average scores for the seven framework conditions across the different country groups. Following conclusions can be drawn from this comparison:

Countries with excellent framework conditions have higher scores than all the other groups in all dimensions. The high levels of entrepreneurial culture, ease of access to the appropriate financial instruments and outstanding access to human capital create favourable framework conditions in these countries, which are conducive to the growth of firms.

The next group of countries, exhibiting very good framework conditions for the growth of firms, has a strong digital infrastructure and broad market expansion possibilities through cross-border e-commerce and foreign direct investments. The main difference with the previous group is a more pronounced difficulty in finding appropriate financial resources needed for the scaling up of the firm.

Countries with good framework conditions have good networking conditions to support the growth of firms. However, this advantage is weakened by the less favourable conditions of the other dimensions.

Finally, countries with fair framework conditions for firm growth are outperformed in almost all dimensions by the other groups. While the levels of access to finance and regulations to favour the growth of firms equal or even exceed those of the previous

group, countries in this group lag behind in all other dimensions. Hence these countries still face tremendous challenges in creating a business context which enhances the growth potential of firms.

Figure 6: Framework conditions per country group for the Scale-up Index



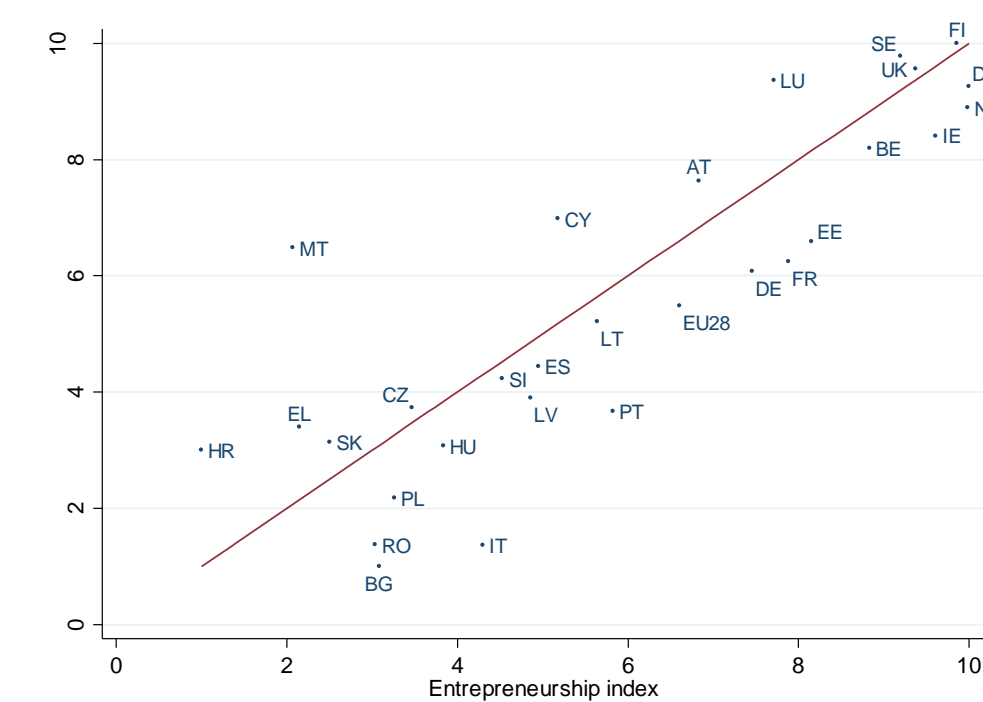
Note: The figure presents the average score of framework conditions per country group on the Entrepreneurship index. Country groups are identified based on their scores: excellent (above 9), very good (above EU average but below 9), good (below EU average but above 3), fair (below 3).

Calculations: EC JRC.

3.3 The relationship between framework conditions for firm creation and growth

The Entrepreneurship and Scale-up index are relatively well correlated, suggesting that countries with favourable framework conditions for the creation of firms also exhibit favourable conditions for the growth and vice versa (see Figure 7). However, the more in-depth analyses below reveal that index scores behind the Entrepreneurship and Scale-up index are driven by different underlying framework conditions.

Figure 7: Comparison of the Entrepreneurship and Scale-up index



Note: The figure presents the relationship between framework conditions for firm creation and growth measured by the Entrepreneurship and Scale-up indices at country level.

Calculations: EC JRC.

4 Framework conditions for firm creation in Europe

4.1 Culture and institutions

Figure 8 benchmarks EU Member States on the framework conditions of culture and institutions. Denmark, Finland and Ireland constitute the top-3 countries, while the most modest scores are reported by Malta, Hungary and Slovenia. These countries present a relatively balanced profile, meaning that they record respectively high and low scores on all the indicators in the pillar.

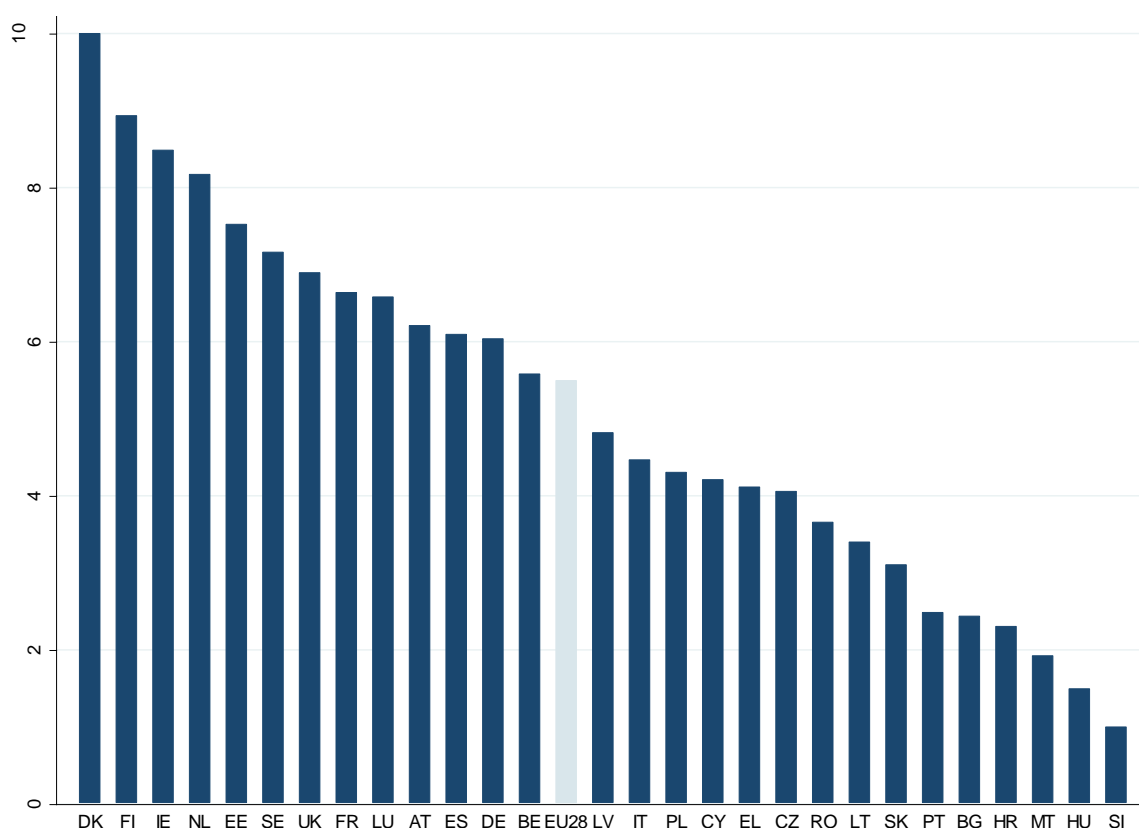
Most of the Eastern and Southern EU Member States score below the EU average, with a notable exception for Estonia. The high score of Estonia is driven by favourable opportunities to start a business and the good image of entrepreneurs, while the willingness to take risks remains relatively modest.

As the pillar score is an aggregated measure of the framework conditions, a more in-depth analysis of the scores of the underlying indicators is needed to understand the pillar score. The pillar score will remain close to the ranking of the underlying indicators if they are well balanced. However, many countries may score well on certain indicators and more poorly on others. To get more insights about the impact of the underlying indicators on the pillar score, we focus particularly on countries with an unbalanced profile. These countries should pay particular attention to improve the indicators on which they perform more weakly.

For the countries with the highest variance in country rankings on the underlying indicators, following conclusions can be drawn:

- Estonia, Belgium, Luxembourg, and Romania score relatively well on opportunity recognition and the image of entrepreneurs but have scope for improvement on risk acceptance.
- France, Ireland and Spain are among the top and middle countries in terms of risk acceptance and image of entrepreneurs, but report more modest levels on opportunity recognition.
- Czech Republic, Slovakia and Cyprus record high levels on risk acceptance but can extensively improve on the image of entrepreneurs and the opportunity recognition.

Figure 8 : Culture and institutions in the Entrepreneurship index



Note: The pillar is built out of the following indicators: Opportunity recognition, Risk acceptance and Image of entrepreneurs. For further methodological details please see Section 7.1. For ease of presentation, pillar scores in the graph have been rescaled with the min-max method to a scale from 1 to 10.

Calculations: EC JRC.

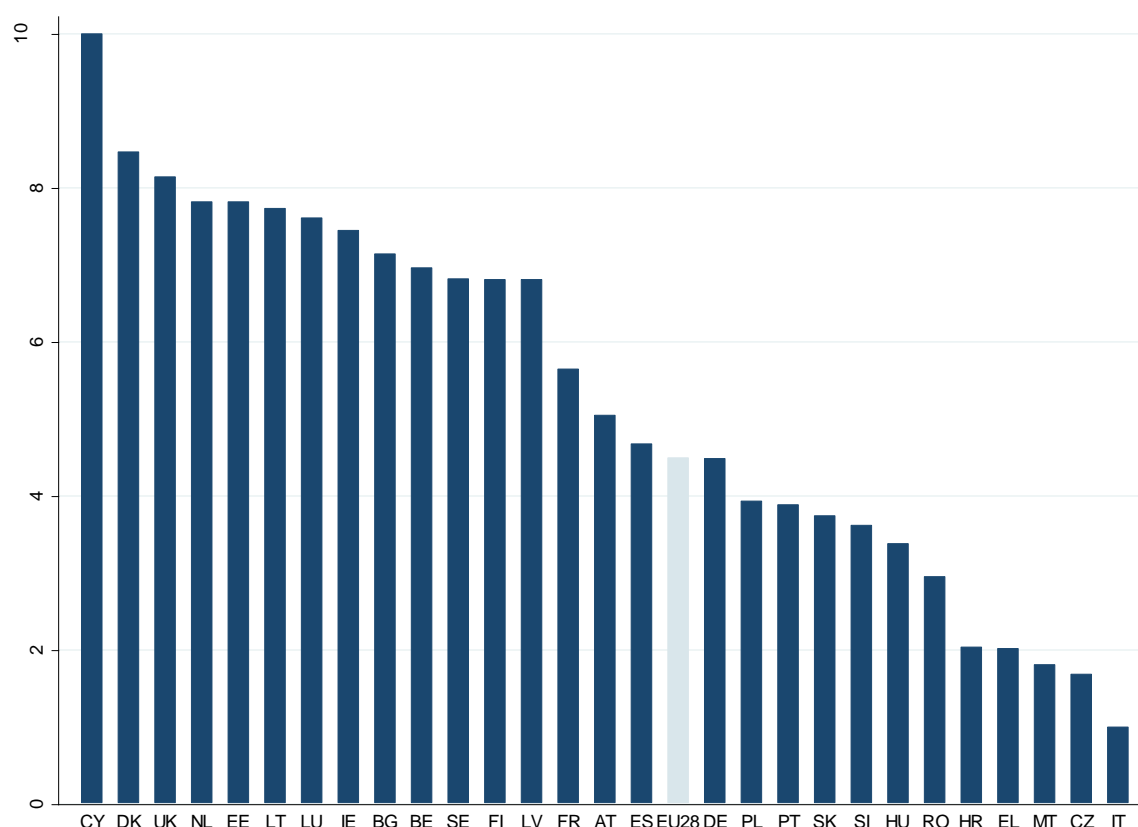
4.2 Access to human capital

Figure 9 benchmarks the EU Member States on the framework conditions of access to human capital. Cyprus, Denmark and United Kingdom constitute the top-3 countries, while the most modest scores are reported by Malta, Czech Republic and Italy. The levels of Cyprus and Malta are completely driven by the score on the percentage of tertiary education as the indicators on education training are not available for these countries.

For the countries with the highest variance in country rankings on the underlying indicators, following conclusions can be drawn:

- Belgium, Luxembourg and Ireland present relatively high percentages of tertiary education but have still scope for improvement on entrepreneurship education.
- Bulgaria and Slovakia report relatively high levels of entrepreneurship education but record modest scores on tertiary education.
- While most countries report similar rankings on the entrepreneurship education during lower and higher education, a limited number of countries diverge extensively on these dimensions. Austria and Portugal have relatively high rankings on entrepreneurship education during higher education, but obtain lower rankings (differences of more than 10 positions) for entrepreneurship education during lower education. The opposite pattern is observed for Romania and Sweden.

Figure 9: Access to human capital in the Entrepreneurship index



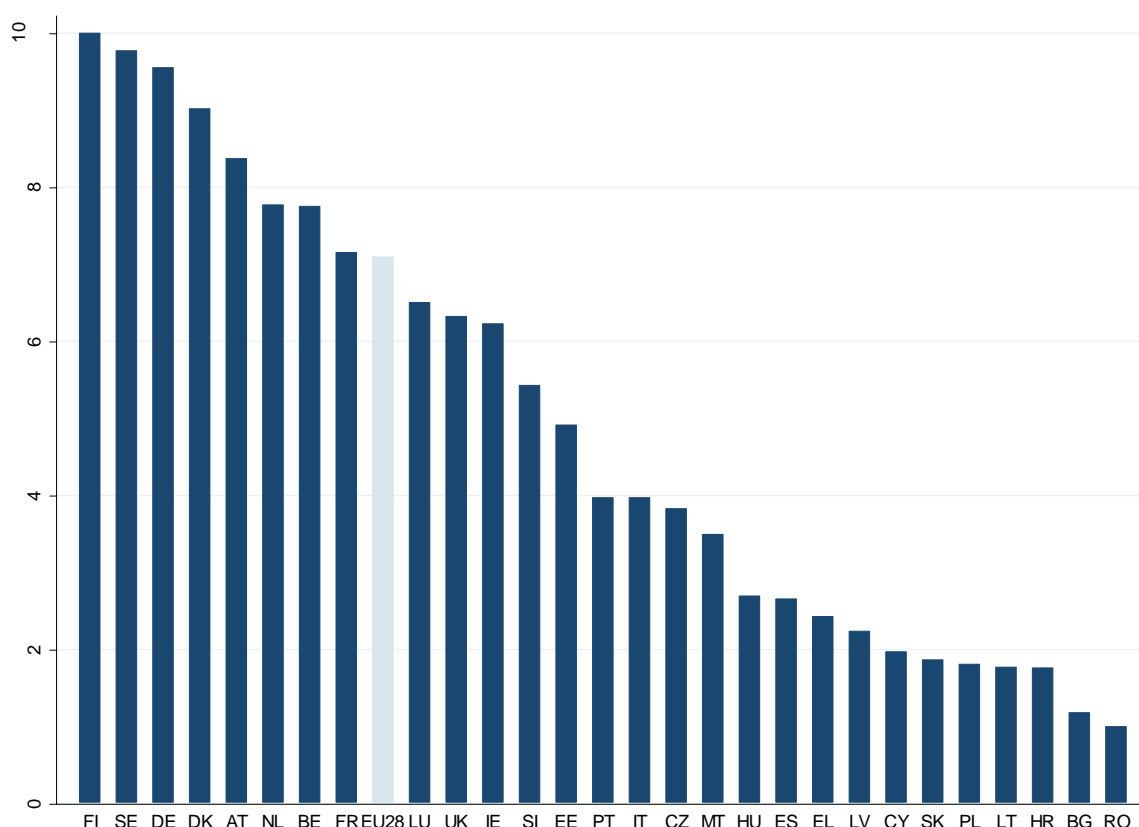
Note: The pillar is built out of the following indicators: Tertiary education, Entrepreneurship education during lower and higher education. For further methodological details please see Section 7.2. For ease of presentation, pillar scores in the graph have been rescaled with the min-max method to a scale from 1 to 10. Calculations: EC JRC.

4.3 Creation of knowledge and networking

Figure 10 benchmarks the EU Member States on the framework conditions of creation of knowledge and networking. Finland, Sweden and Germany constitute the top-3 countries, while the most modest scores are reported by Croatia, Bulgaria and Romania.

The country rankings of the underlying indicators are relatively balanced. Luxembourg is the country with the most outspoken unbalance. While being among the top countries in intellectual property rights and percentage of product and process innovations, it scores below EU average in terms of business R&D expenditures and patents per GDP.

Figure 10: Creation of knowledge and networking in the Entrepreneurship index



Note: The pillar is built out of the following indicators: R&D expenditure, Intellectual property right, Number of patents, Product and process innovations. For further methodological details please see Section 7.3. For ease of presentation, pillar scores in the graph have been rescaled with the min-max method to a scale from 1 to 10.

Calculations: EC JRC.

4.4 Market conditions

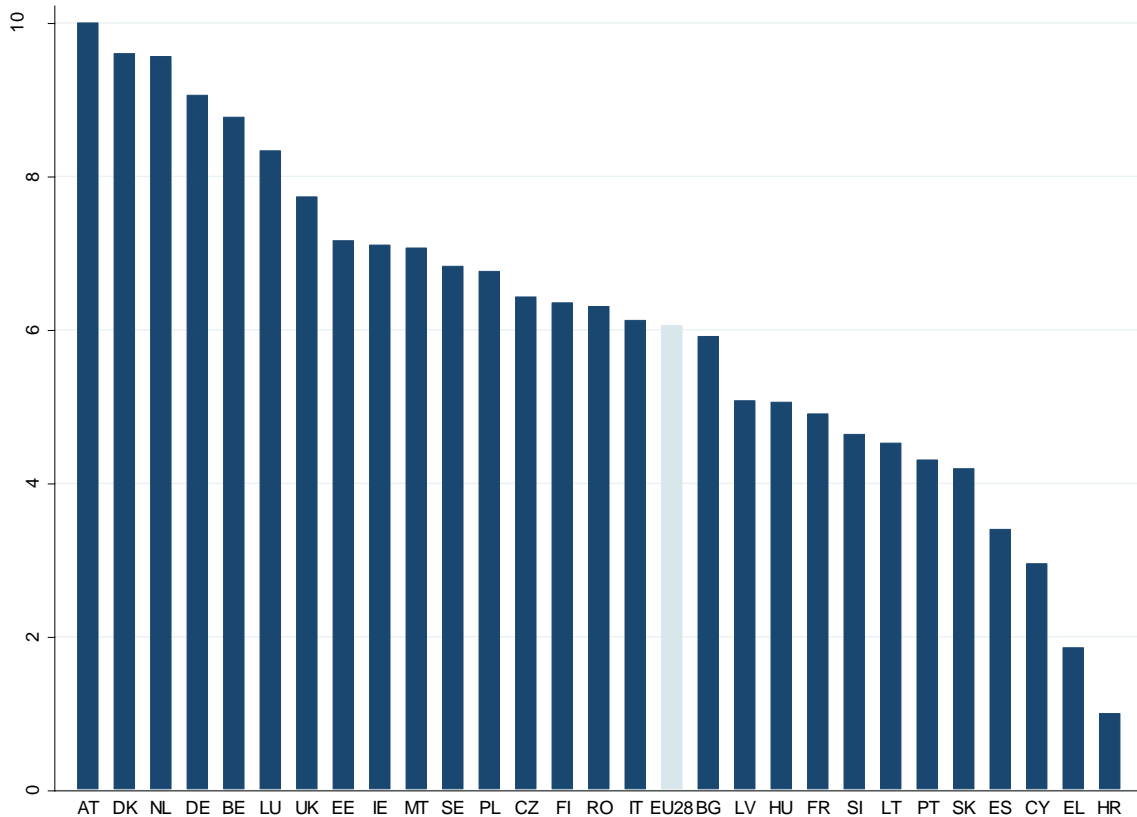
Figure 11 benchmarks the EU Member States on the framework conditions of market conditions. Austria, Denmark and the Netherlands constitute the top-3 countries, while the most modest scores are reported by Cyprus, Greece and Croatia. While the lowest ranked countries present a relatively balanced profile, top-ranked countries do not report top scores on all indicators and still have scope for improvement. Most striking examples are the Netherlands and Germany. Despite the leader position on the indicators of market dominance and unemployment rate, Germany ranks only fourth at pillar level due to a lower ranking on market openness. The Netherlands scores well in terms of market dominance and market openness but lags behind on unemployment rate (10th position).

For the countries with the highest variance in country rankings on the underlying indicators, following conclusions can be drawn:

- Bulgaria is the best ranked country in terms of market openness. However, its pillar rank is situated beyond the EU average due to more modest country ranks on unemployment rate and market dominance.
- Czech Republic and Hungary report low unemployment rates, but the market dominance and market openness indicators are close to or below the EU average.

- Despite similar pillar scores, Italy and Romania exhibit opposite patterns on their underlying scores. While Italy performs well on market dominance, it obtains more modest scores on unemployment and market openness.

Figure 11: Market conditions in the Entrepreneurship index



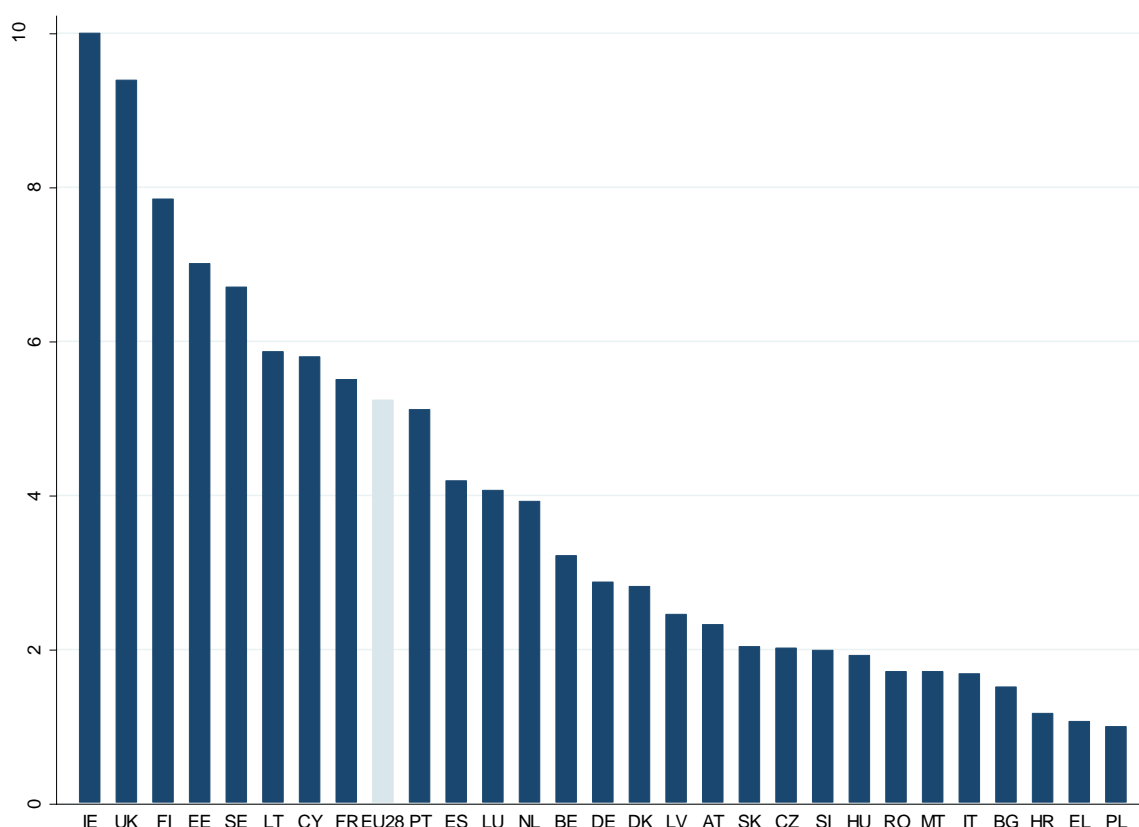
Note: The pillar is built out of the following indicators: Market dominance, Unemployment rate and Internal market openness. For further methodological details please see Section 7.4. For ease of presentation, pillar scores in the graph have been rescaled with the min-max method to a scale from 1 to 10. Calculations: EC JRC.

4.5 Access to finance

Figure 12 benchmarks the EU Member States on the framework conditions of access to finance. Ireland, United Kingdom and Finland constitute the top-3 countries, while the most modest scores are reported by Croatia, Greece and Poland. As explained in section 8.1 this pillar suffers from missing data, primarily caused by a lack of data availability on the alternative finance indicator at the moment of writing this report.

The country rankings of the underlying indicators are relatively balanced. Portugal is the country with the most outspoken unbalance. While being a top-country in number of business angels per GDP, it is situated at the end of the country rankings in terms of VC funding at the seed and first stage per GDP.

Figure 12: Access to finance in the Entrepreneurship index



Note: The pillar is built out of the following indicators: Seed and first-stage VC funding, Business angels and Alternative finance. For further methodological details please see Section 7.5. For ease of presentation, pillar scores in the graph have been rescaled with the min-max method to a scale from 1 to 10.

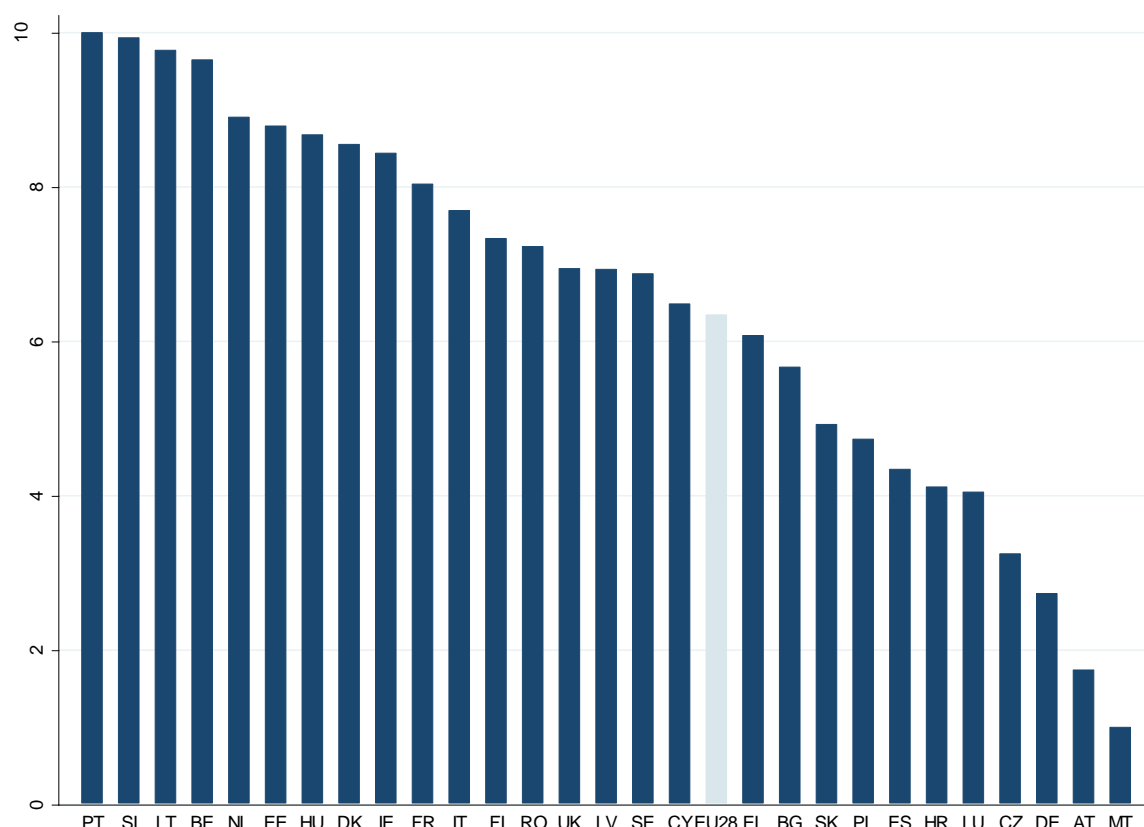
Calculations: EC JRC.

4.6 Tax and regulations

Figure 13 benchmarks the EU Member States on the framework conditions of tax and regulations. Portugal, Slovenia and Latvia constitute the top-3 countries, while the most modest scores are reported by Germany, Austria and Malta. These six countries present a relatively balanced profile, with the exception of Slovenia being a top country in number of procedures to start-up a business but lagging behind (at the 11th position) on the indicator measuring the number of days to start a business.

While the majority of countries report similar rankings on both underlying indicators of the pillar, a limited number of countries diverge significantly on them, revealing extensive scope for improvement. Bulgaria, Finland, Poland and Sweden report high to average country rankings in terms of number of procedures to start up a business, while being among the lowest ranked countries what concerns the timing needed to start a business. The opposite pattern is observed for France and United Kingdom.

Figure 13: Tax and regulations in the Entrepreneurship index



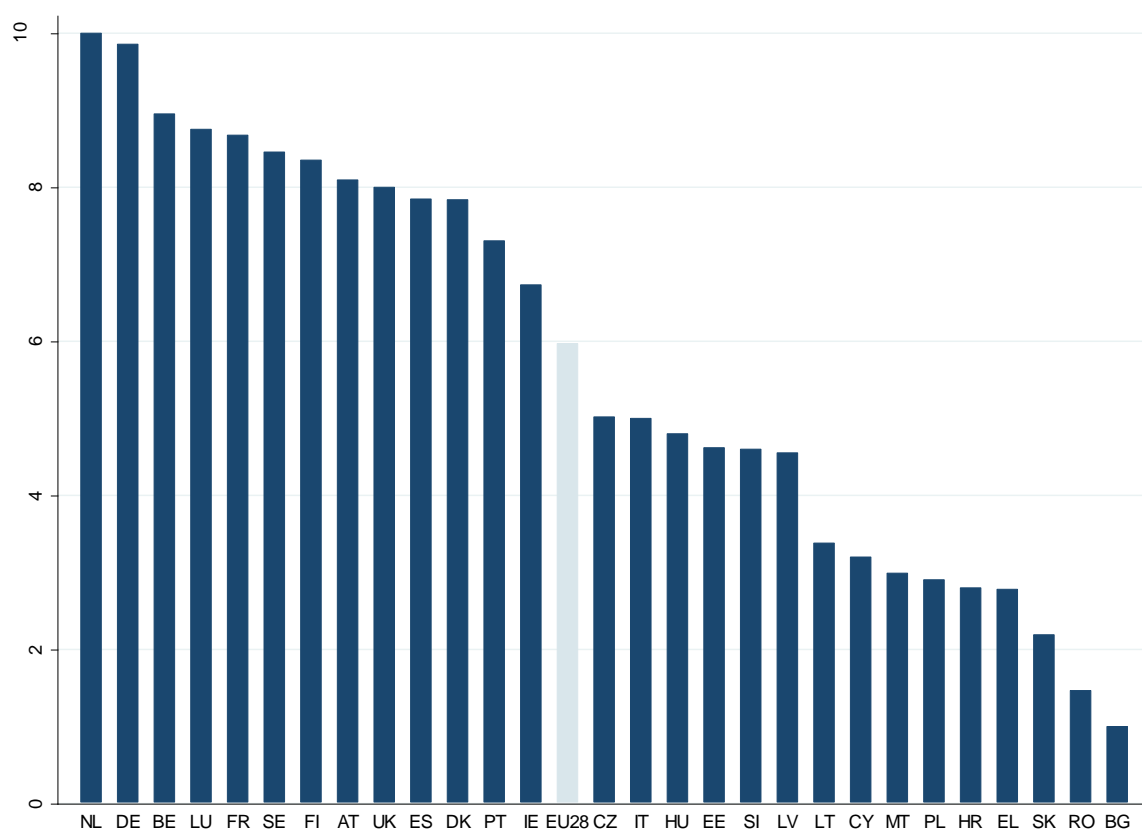
Note: The pillar is built out of the following indicators: Number of days for starting a business and number of procedures for starting a business. For further methodological details please see Section 7.6. For ease of presentation, pillar scores in the graph have been rescaled with the min-max method to a scale from 1 to 10. Calculations: EC JRC.

4.7 Infrastructure and support

Figure 14 benchmarks the EU Member States on the framework conditions of infrastructure and support. Netherlands, Germany and Belgium constitute the top-3 countries, while the most modest scores are reported by Slovakia, Romania and Bulgaria. These six countries present a relatively balanced profile.

While the majority of countries report similar rankings on both underlying indicators of the pillar, a limited number of countries diverge significantly on them, revealing extensive scope for improvement. Cyprus reports relatively good country rankings in terms of the quality of infrastructure, while being at the lower end of the distribution what concerns the quality of logistics. The opposite pattern is observed for Italy and Poland.

Figure 14: Infrastructure and support in the Entrepreneurship index



Note: The pillar is built out of the following indicators: Logistics index and quality of infrastructure. For further methodological details please see Section 7.7. For ease of presentation, pillar scores in the graph have been rescaled with the min-max method to a scale from 1 to 10.

Calculations: EC JRC.

5 Framework conditions for firm growth in Europe

5.1 Culture and institutions

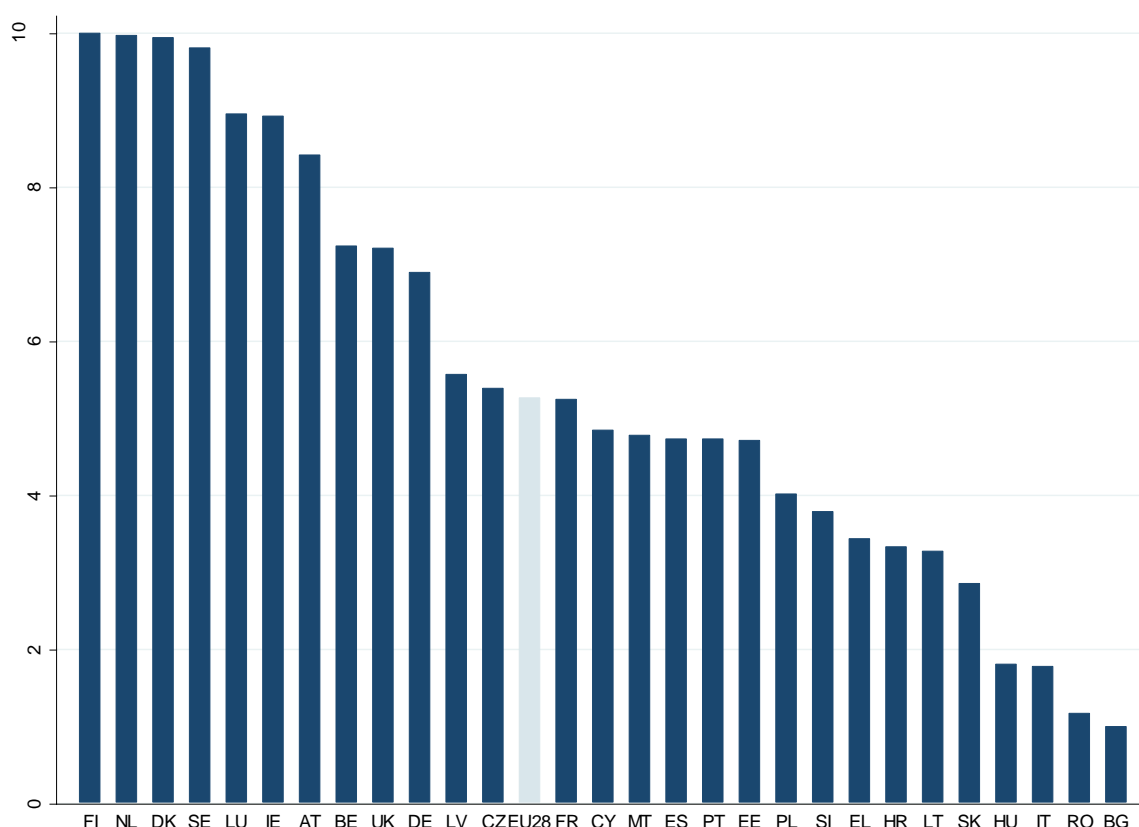
Figure 15 benchmarks the EU Member States on the framework conditions of culture and institutions. Finland, Netherlands and Denmark constitute the top-3 countries, while the most modest scores are reported by Italy, Romania and Bulgaria.

The country rankings of the underlying indicators are relatively balanced. Estonia and Spain are the countries with the most outspoken unbalances. Estonia records relatively good scores on the reliance of professional management and willingness to delegate, but tends to be at the lower end of the country ranking as regards to the integrity of the legal system. The opposite pattern is observed for Spain.

The squared value of the Pearson correlation between the pillars on Culture and institutions for the Entrepreneurship and the Scale-up index elevates at 0.64. This score suggests that both pillars are relatively well correlated but that many countries still diverge extensively on the framework conditions of culture and institutions that are conducive for start-ups and scale-up firms. Examples of countries for which the country ranks differ more than 10 positions between the two pillars:

- Estonia and Italy: while exhibiting relatively good framework conditions on the culture pillar of the Entrepreneurship index, these countries are far beyond the EU average on the pillar of the Scale-up index (respectively 5th-19th and 16th-27th).
- The opposite pattern is observed for Malta, with respective ranks at 16th and 27th positions.

Figure 15: Culture and institutions in the Scale-up index



Note: The pillar is built out of the following indicators: Integrity of the legal system, Reliance on professional management and Willingness to delegate authority. For further methodological details please see Section 7.1. For ease of presentation, pillar scores in the graph have been rescaled with the min-max method to a scale from 1 to 10.

Calculations: EC JRC.

5.2 Access to human capital

Figure 16 benchmarks the EU Member States on the framework conditions of access to human capital. Belgium, Netherlands and United Kingdom constitute the top-3 countries, while the most modest scores are reported by Slovakia, Greece and Bulgaria.

The country rankings of the underlying indicators are relatively balanced. Only a limited number of countries show a large variance in country rankings on the underlying indicators. For these countries following conclusions can be drawn:

- Countries with top rankings (Spain and Portugal) or ranked close to the EU average (Italy) in terms of quality of management schools score well below EU averages on staff training and percentage of managerial and technical occupations.

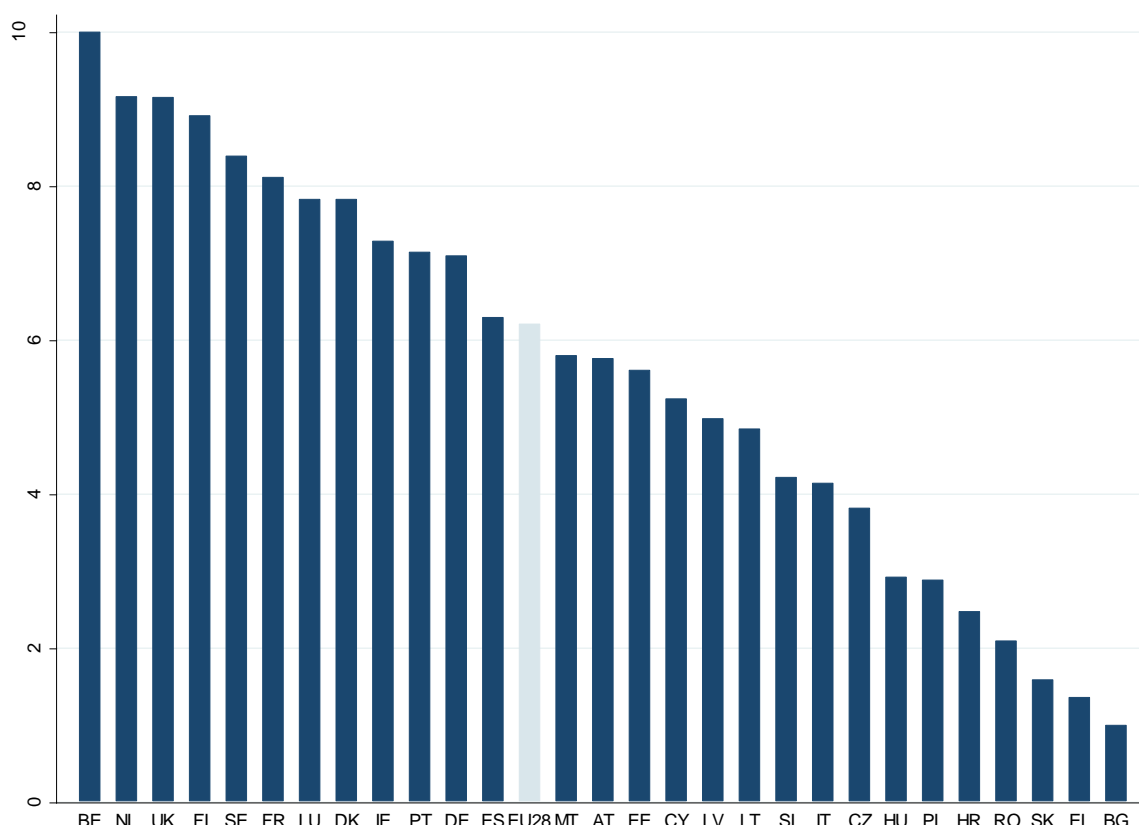
The squared value of the Pearson correlation between the pillars on Access to human capital for the Entrepreneurship and the Scale-up index elevates at 0.31. Almost sixty percent of the countries diverge more than four positions on country ranks across the pillars. Examples of countries for which the country ranks differ more than 10 positions between the two pillars:

- Cyprus, Estonia, Latvia and Bulgaria: while exhibiting relatively good framework conditions the human capital pillar of the Entrepreneurship index, these countries

score well beyond the EU average on the pillar of the Scale-up index (respectively, 1st-17th, 5th-16th, 6th-19th and 9th-29th).

- The opposite pattern is observed for Portugal, with respective ranks at 10th and 20th positions.

Figure 16: Access to human capital in the Scale-up index



Note: The pillar is built out of the following indicators: Availability of managerial and technical capabilities on the labour market, quality of management schools and staff training. For further methodological details please see Section 7.2. For ease of presentation, pillar scores in the graph have been rescaled with the min-max method to a scale from 1 to 10.

Calculations: EC JRC.

5.3 Creation of knowledge and networking

Figure 17 benchmarks the EU Member States on the framework conditions of access to human capital. Slovenia, Finland and United Kingdom constitute the top-3 countries, while the most modest scores are reported by Bulgaria, Malta and Italy.

The country rankings of the underlying indicators are relatively balanced. Only a limited number of countries show a large variance in country rankings on the underlying indicators. For these countries following conclusions can be drawn:

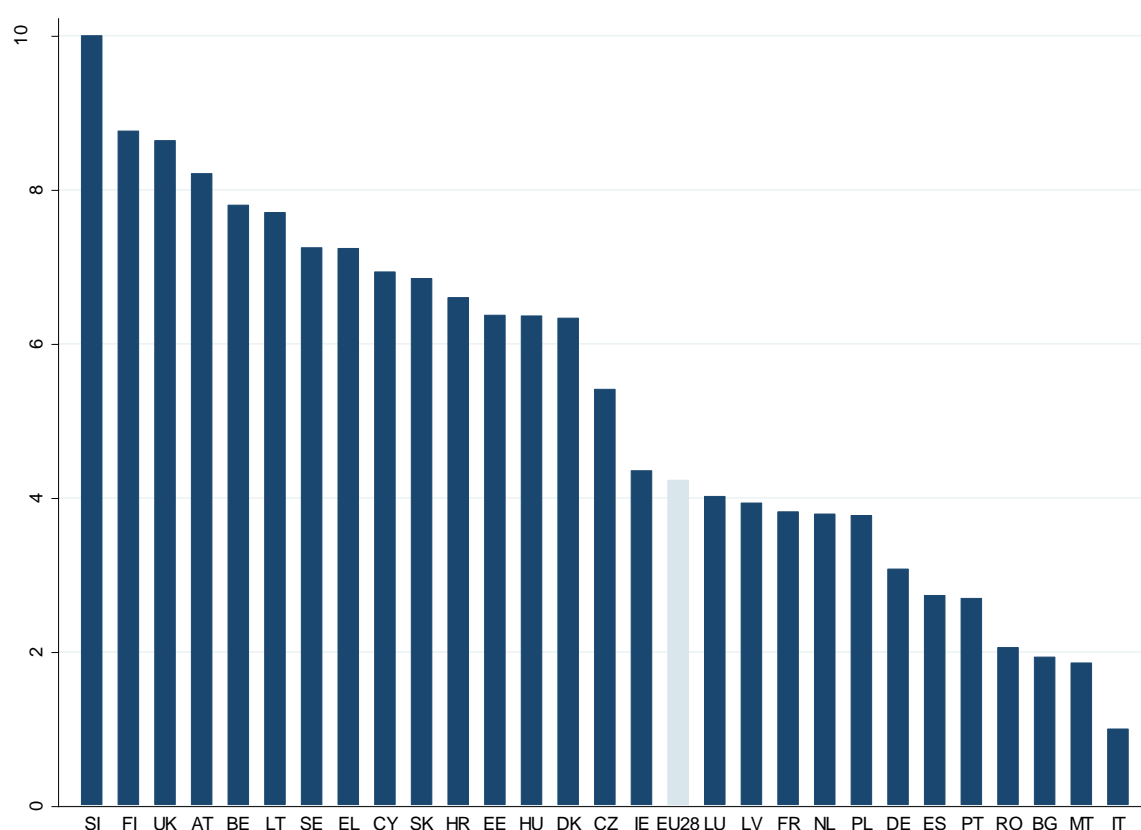
- The most striking variance is observed for Cyprus: this country is at the top of the rankings with respect to collaboration with other firms, customers and with international partners, but is ranked last in terms of university-industry collaborations.

The squared value of the Pearson correlation between the pillars on Creation of knowledge and networking for the Entrepreneurship and the Scale-up index elevates at

0.07. This score points at a low correlation between both pillars and suggests that many countries diverge extensively on the framework conditions of creation of knowledge and networking that are conducive for start-ups and scale-up firms. More than half of the countries record differences in country rankings across the two pillars equal to or more than 8 positions. Examples of countries for which the country ranks differ of 15 positions or more between the two pillars:

- Being among the top-ranked countries on the knowledge pillar of the Entrepreneurship index, the Netherlands and Germany record very modest scores on the pillar of the Scale-up index (respective differences of 6th-21st and 3rd-23rd).
- Although recording relative good rankings on the knowledge pillar of the Scale-up index, Latvia and Hungary are among the lowest ranked countries on the pillar of the Entrepreneurship index (respective differences of 6th-26th and 11th-27th).

Figure 17: Creation of knowledge and networking in the Scale-up index



Note: The pillar is built out of the following indicators: Collaboration with other firms, collaboration with customers, university-industry collaboration and international collaboration. For further methodological details please see Section 7.3. For ease of presentation, pillar scores in the graph have been rescaled with the min-max method to a scale from 1 to 10.

Calculations: EC JRC.

5.4 Market conditions

Figure 18 benchmarks the EU Member States on the framework conditions of market conditions. Luxembourg, Ireland and, the Netherlands constitute the top-3 countries, while the most modest scores are reported by Bulgaria, Hungary and Romania.

Countries on the extreme ends of the ranking distribution are relatively balanced on the scores of the underlying indicators. Countries with a high pillar score record high scores

on all the underlying indicators, while the opposite is true for the lowest ranked countries.

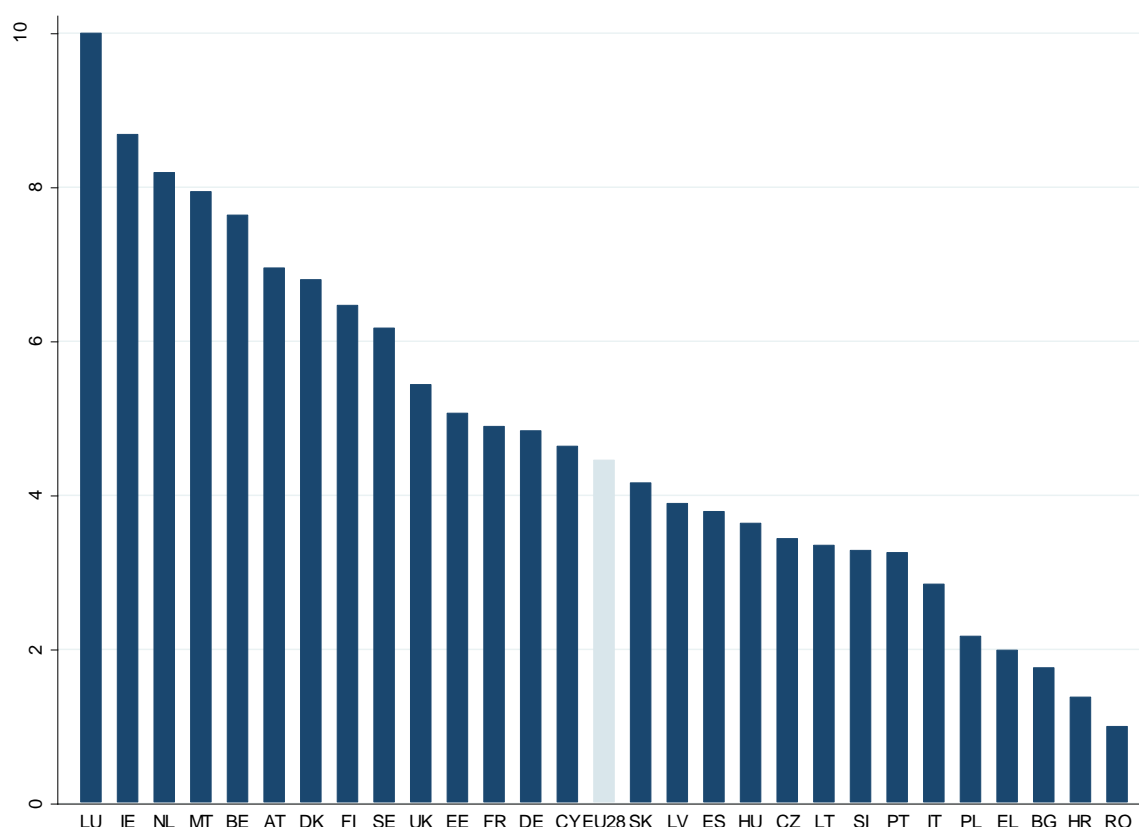
The country rankings of the underlying indicators in the middle of the distribution are relatively unbalanced. Following observations can be drawn for the countries with the highest variance across underlying indicators:

- Germany has one of the largest markets of EU28 in terms of GNI per capita but lags behind what concerns market expansion strategies through foreign direct investments and cross-border e-commerce.
- Although having a relatively good position what concerns market size and foreign direct investment, Italy scores relatively weak in terms of foreign competition and cross-border e-commerce. A similar pattern – though less pronounced – is observed for Spain.

The squared value of the Pearson correlation between the pillars on Market conditions for the Entrepreneurship and the Scale-up index elevates at 0.47. This score suggests that both pillars are relatively well correlated but that many countries still diverge extensively on the framework conditions of market conditions that are conducive for start-ups and scale-up firms. Examples of countries for which the country ranks differ more than 10 positions between the two pillars:

- Cyprus: obtains an average ranking position for the market conditions pillar of the Scale-up index, but is ranked last but one on the pillar of the Entrepreneurship index (respectively, 14th-27th).
- The opposite pattern is observed for Romania and Poland (respectively 25th-12th and 29th-15th).

Figure 18: Market conditions in the Scale-up index



Note: The pillar is built out of the following indicators: Market size, foreign competition, cross-border e-commerce and foreign direct investment. For further methodological details please see Section 7.4. For ease of presentation, pillar scores in the graph have been rescaled with the min-max method to a scale from 1 to 10. Calculations: EC JRC.

5.5 Access to finance

Figure 19 benchmarks the EU Member States on the framework conditions of access to finance. Sweden, United Kingdom and Luxembourg constitute the top-3 countries, while the most modest scores are reported by Greece, Hungary and Slovenia.

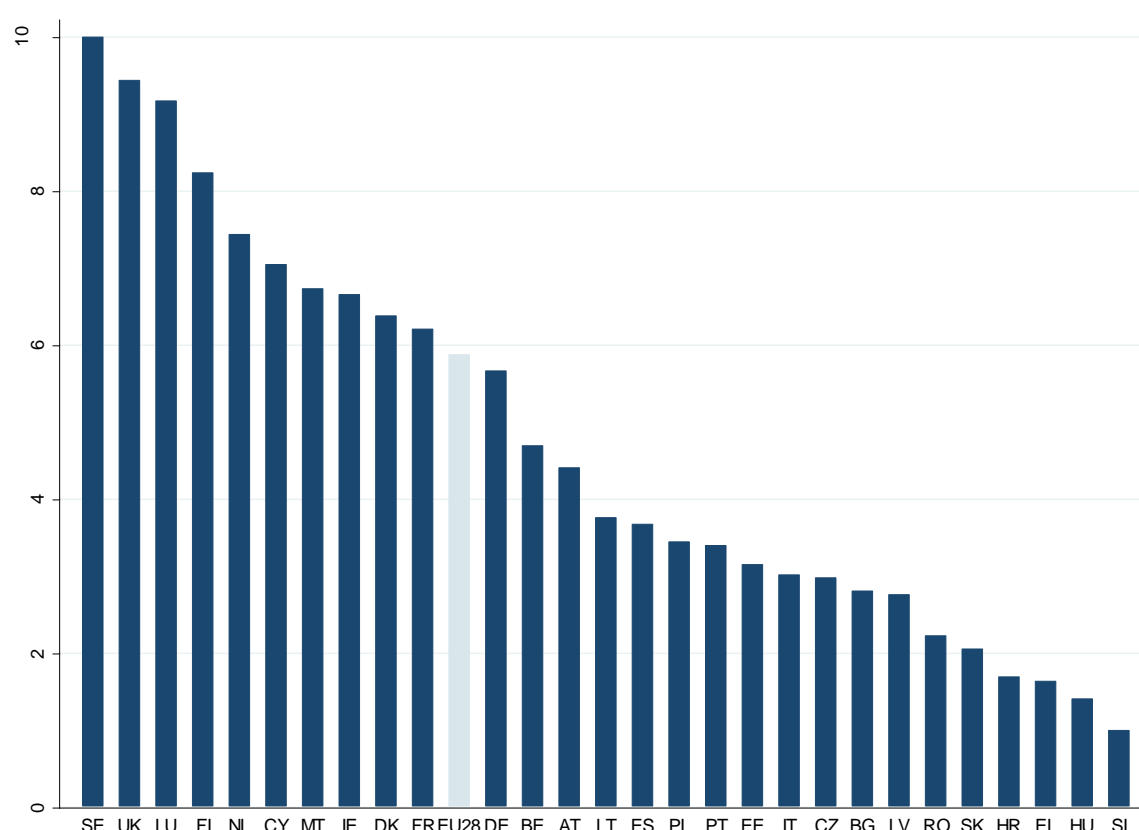
The country rankings of the underlying indicators are relatively balanced. Following observations can be drawn for the countries with the highest variance across underlying indicators:

- Denmark is ranked as the second best country in terms of the VC amount obtained during the second and later stage. In sharp contrast with this score, the WEF indicator on the ease of access of VC funding reports Denmark among the weakest countries. A similar pattern is observed for Cyprus. These results can partially be explained by the fact that the WEF indicators take all VC stages into account.
- Estonia has a relatively good ranking on the ease of accessing equity markets (12th position), but reveals to be among the weakest countries in terms of IPO numbers per GDP (27th position).
- The rankings of the underlying indicators for Spain and Portugal, suggest that these countries are primarily relying on bank credits (4th position) and seem to face more difficulties in accessing and obtaining funding from VC and equity markets. Opposite patterns are observed for Sweden and United Kingdom.

The squared value of the Pearson correlation between the pillars on Access to finance for the Entrepreneurship and the Scale-up index elevates at 0.45. This score suggests that both pillars are relatively well correlated but that several countries still diverge extensively on the framework conditions of culture and institutions that are conducive for start-ups and scale-up firms. Examples of countries for which the country ranks differ more than 10 positions between the two pillars:

- Estonia: among the best countries on the finance pillar of the Entrepreneurship index, but performing well beyond the EU average on the pillar of the Scale-up index (respectively 4th-19th).
- The opposite patterns are observed for Malta and Poland, performing weakly on the pillar of the Entrepreneurship but ranking relatively well on the Scale-up pillar.

Figure 19: Access to finance in the Scale-up index



Note: The pillar is built out of the following indicators: Bank credit to private sector, ease of access to venture capital, second and later stage VC funding, ease of access to equity market and finance through equity markets. For further methodological details please see Section 7.5. For ease of presentation, pillar scores in the graph have been rescaled with the min-max method to a scale from 1 to 10.

Calculations: EC JRC.

5.6 Tax and regulations

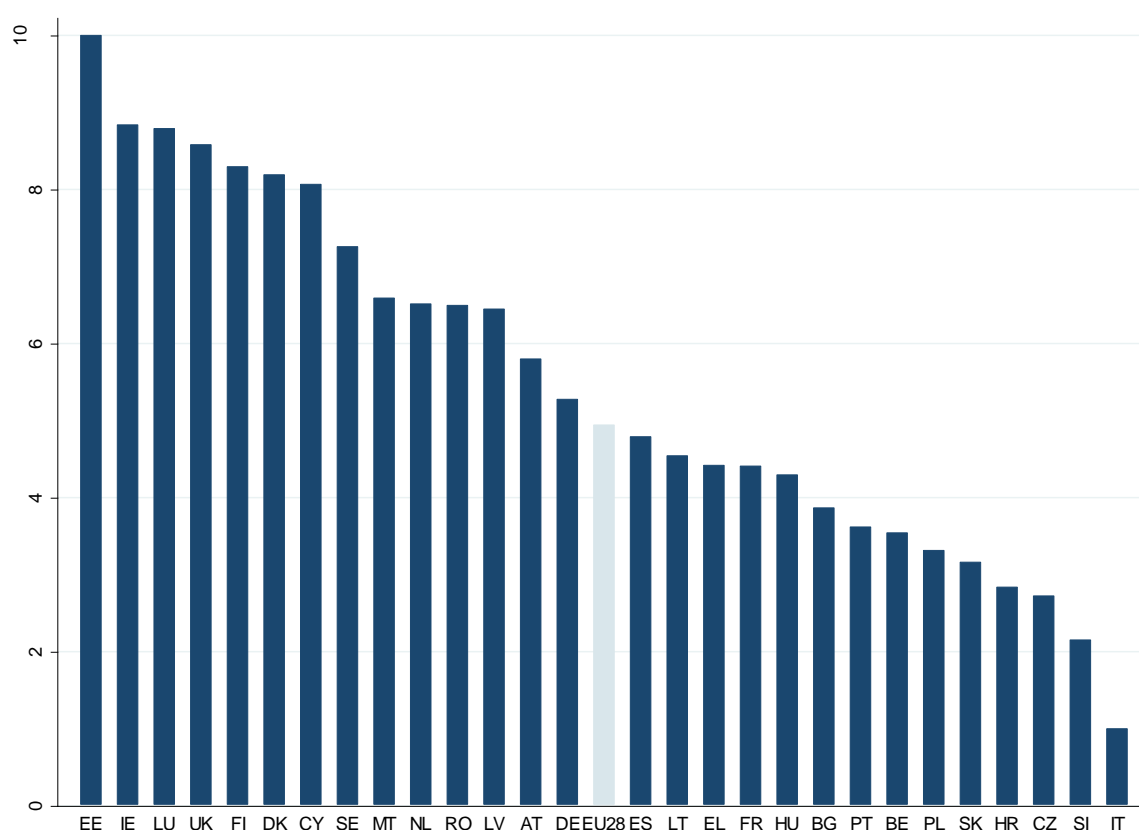
Figure 20 benchmarks the EU Member States on the framework conditions of tax and regulations. Estonia, Ireland and Luxembourg constitute the top-3 countries, while the most modest scores are reported by the Czech Republic, Slovenia and Italy.

The country rankings of the underlying indicators are relatively balanced. Following observations can be drawn for the countries with the highest variance across underlying indicators:

- Although Latvia and the Netherlands obtain similar pillar rankings, they are driven by different indicators. While the Netherlands is among the top countries in terms of time spent on taxation issues, it scores weakly on hiring regulations. The opposite pattern is observed for Latvia.
- A similar observation holds for Bulgaria and France.

The squared value of the Pearson correlation between the pillars on Tax and regulations for the Entrepreneurship and the Scale-up index is practically equal to zero. This score suggests that both pillars are not correlated and that framework conditions on Tax and regulations as measured by the Entrepreneurship and Scale-up index diverge extensively. A main drawback of the existing regulatory framework is that it is not adequate to support new forms of economic activity. One of the uprising economic activities that falls under this category is the sharing economy (see Box 1).

Figure 20: Tax and regulations in the Scale-up index



Note: The pillar is built out of the following indicators: Time spent on tax issues, hiring and firing regulations and burden of government regulation. For further methodological details please see Section 7.6. For ease of presentation, pillar scores in the graph have been rescaled with the min-max method to a scale from 1 to 10. Calculations: EC JRC.

Box 1: Regulations in the sharing economy

The sharing economy is a hub of peer-to-peer activity for obtaining, giving, or sharing access, and is coordinated through a web interface featuring community feedback (Hamari, Sjöklint, & Ukkonen, 2016). It includes sharing platforms as Uber, Airbnb and Lyft. These "online market places" are becoming increasingly popular as they drastically decrease the transaction costs of consumers in their search for goods and services. Hence, the value of the global sharing economy was estimated at 26 billion dollar in 2013 and is only expected to continue gaining in importance in the upcoming years (Cannon & Summers, 2014).

Many of the firms active in the sharing economy belong to the high-growth firms' category as most of them exhibit tremendous growth rates. A major driver for the increasing popularity and the exceptional growth trajectories of these firms also stems from the efficient and flexible business model that they employ. It relies on the principle of self-employment, implying that individuals are taking over the role of entrepreneurs by for instance renting their houses/flats (in the case of Airbnb) or driving people around (in the of Uber and Lyft). This business model is beneficial to the firms in the sharing economy as they only need to provide an online platform without facing the high fixed assets costs imposed to their counterparts active in the traditional economy. However, exactly due to this innovative business model, sharing economy firms are operating in a grey zone that is not contained in the existing regulatory framework.

Two main issues that have to be addressed in order to develop an effective regulation of the sharing economy are: 1) the excessive amount of outdated regulations and 2) the absence of regulation. The first issue rest upon the rigidity of regulation systems rendering them incapable of updating the regulation at the same speed as organizational changes in the economy. A key example of the impact of obsolete regulation is the prohibition of Uber services in Germany pronounced by the Berlin's District Court in 2014 (Ranchordás, 2015). The judgement was based on the fact that Uber did not comply with the laws in place regarding rental car services. According to these laws, taxi drivers need to return to the place of business after every assignment. However, as Uber services are provided by private individuals they keep on circulating in the city as they have no business place to return to. This example calls for a better alignment of existing regulations across the various types of business models active on the market.

The second issue stems from the fact that the actual regulation is not covering certain practices of the new business models in the sharing economy leaving governments with many unanswered questions. The regulation contains for instance huge gaps concerning the responsibility of individuals that act as "entrepreneurs" on behalf of Airbnb and Uber. While traditional rental car companies and hotels have to comply with specific regulations about safety, liability, licensing and insurances, the private contractors acting in the sharing economy are not legally bound to regulatory compliance. To overcome these issues most of the firms in the sharing economy have integrated a self-regulating peer review system based on experiences and scores provided by customers. While it is an efficient feature to punish and even ban certain contractors that provide poor services, it is certainly not a sufficient tool for the provision of a formal, accountable, and enforceable regulatory framework.

As stipulated by Dostmohammad and Lung (2015), "the rise of self-regulation should compel governments to act decisively on the issue in order to restore confidence in the regulatory process". Only recently local governments have started putting in place mechanisms to better control and monitor the compliance with safety, insurances and hygiene. Property owners that rent their house or flat in Brussels (including through channels such as Airbnb) are for instance obliged to register at the local administration and need to comply with several regulations in order to get the green light for their renting activities.

5.7 Infrastructure and support

Figure 21 benchmarks the EU Member States on the framework conditions of infrastructure and support. Denmark, the Netherlands and Sweden constitute the top-3 countries, while the most modest scores are reported by Latvia, Poland and Romania.

Countries on the extreme ends of the ranking distribution are relatively balanced on the scores of the underlying indicators. Countries with a high pillar score record high scores on all the underlying indicators, while the opposite is true for the lowest ranked countries.

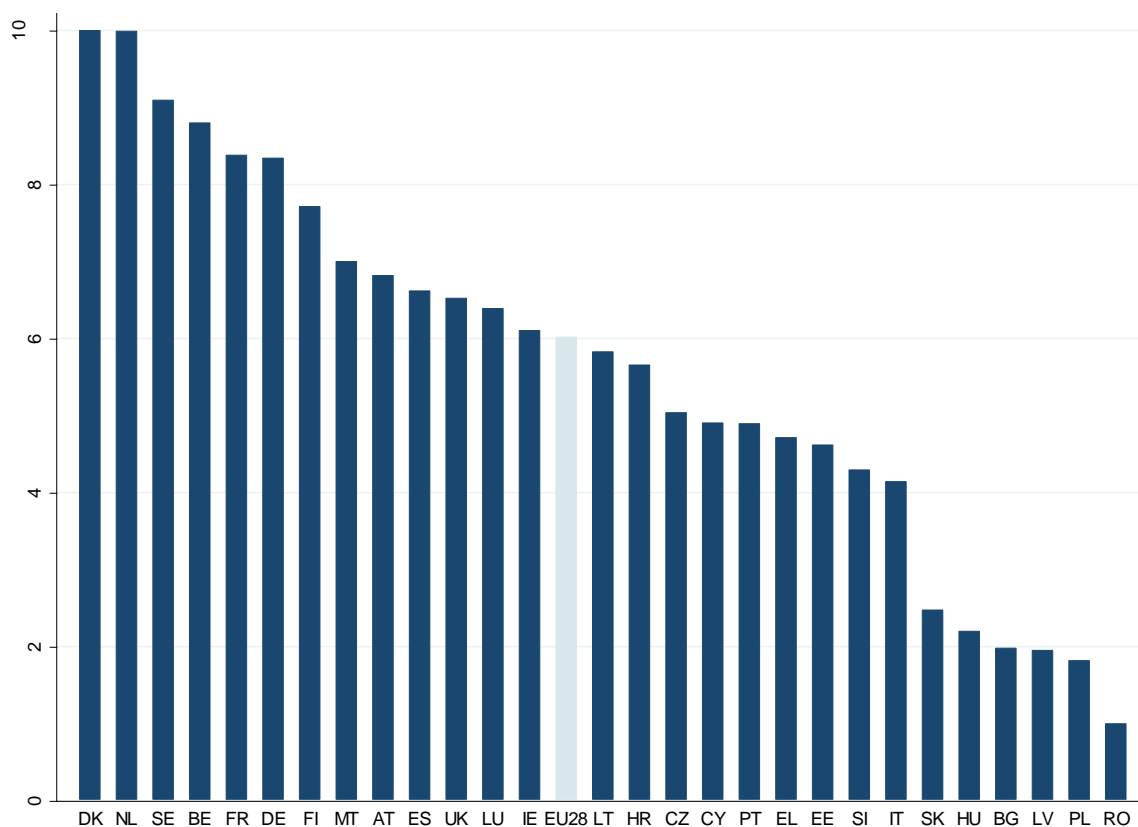
The country rankings of the underlying indicators in the middle of the distribution are relatively unbalanced. Following observations can be drawn for the countries with the highest variance across underlying indicators:

- Austria, Greece, Italy and Portugal have relatively good positions on the rankings of the percentage of firms using ERC packages but are reporting low ranking positions on the indicators of broadband access and e-commerce.
- Croatia, Ireland and the Czech Republic are among the top-countries in terms of e-commerce but belong to the weakest countries on the two other indicators. The opposite pattern is observed for Luxembourg.

The squared value of the Pearson correlation between the pillars on Infrastructure and support for the Entrepreneurship and the Scale-up index elevates at 0.62. This score suggests that both pillars are relatively well correlated. Only two countries exhibit differences in country rankings equal to or more than 10 positions:

- Denmark and Malta: respectively top country and average-ranked country on the infrastructure pillar of the Scale-up index, but recording rankings in the middle and lowest end of the distribution for the Entrepreneurship index (respective differences: 1st-11th and 8th-23rd).

Figure 21: Infrastructure and support in the Scale-up index



Note: The pillar is built out of the following indicators: E-commerce, use of ERP packages and broadband access. For further methodological details please see Section 7.7. For ease of presentation, pillar scores in the graph have been rescaled with the min-max method to a scale from 1 to 10.

Calculations: EC JRC.

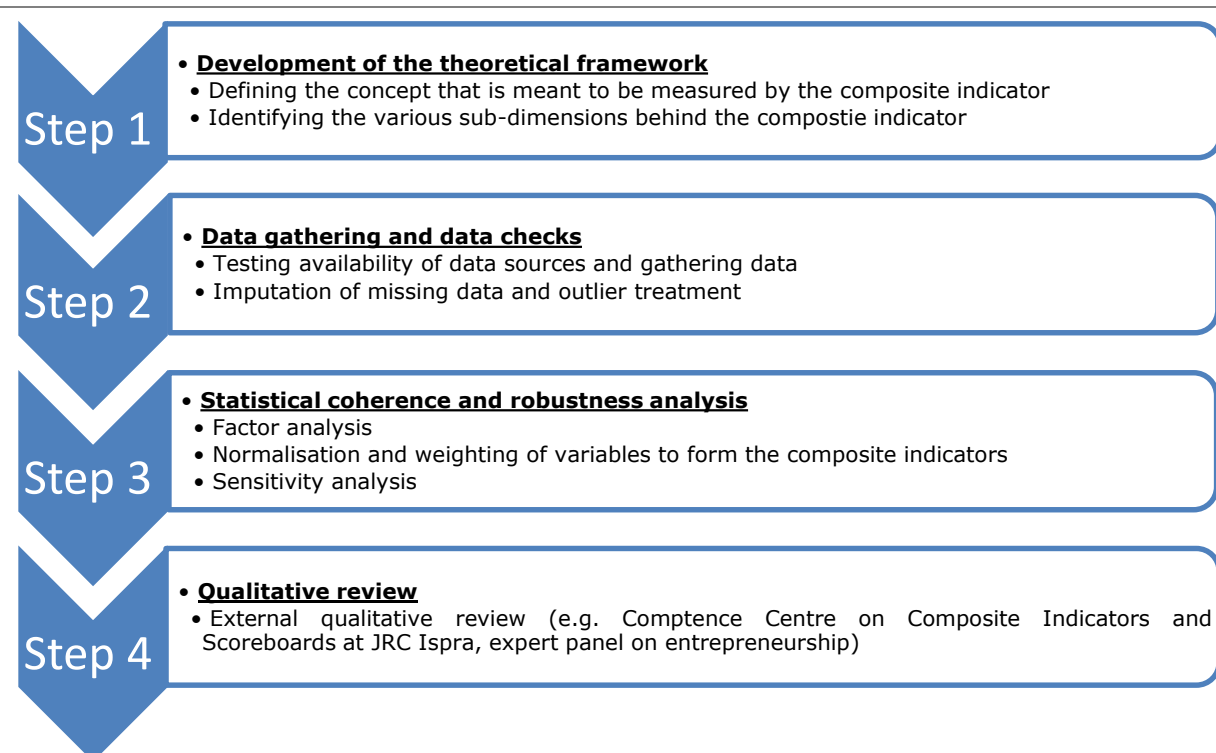
6 Methodological steps

To ensure an analytically sound and transparent construction of the Entrepreneurship and Scale-up index, the methodological steps suggested by the OECD/JRC handbook have been followed (OECD & JRC, 2008). The construction of the indices has been guided by the following steps: 1. the development of a theoretical framework defining the concept and the dimensionality of what is meant to be measured; 2. the gathering of data accompanied with general data checks (e.g., availability of indicators/variables, imputation of missing values, outlier treatment); 3 the statistical choices to ensure the coherence and robustness of the composite indicator (e.g. factor analysis, normalisation and weighting methods); and eventually 4. a quality assessment from expert bodies in order to get suggestions and reviews about the decisions undertaken in the previous stages of analysis. The sequence for the construction procedure is depicted in Figure 22.

The remainder of the report is structured along this outline. Section 7 presents an overview of the framework conditions that are analysed in ESIS. In particular, it identifies and assesses which components of the framework conditions are affecting the creation and growth of entrepreneurial activities. It provides the rationale for the various indicators that are feeding the indices. For completeness and full transparency, Member States rankings for the raw indicators are presented in appendix.

Section 8 focuses on steps 2 till 4 and provides an in-depth analysis of the statistical methodology to construct ESIS. It includes an overview of the normalisation, aggregation and weighting methods used for the construction of the indices and provides a robustness analysis to assess the statistical coherence of ESIS.

Figure 22: Methodological steps for the construction of ESIS



Source: Based on the OECD/JRC handbook on constructing composite indicators (OECD & JRC, 2008).

7 Theoretical framework

This section reviews the theoretical framework behind ESIS, which distinguishes seven framework conditions in line with those used in other measurement frameworks (Audretsch & Belitski, 2016; OECD, 2013):

- Culture and institutions,
- Access to human capital,
- Creation of knowledge and networking,
- Market conditions,
- Access to finance,
- Tax and regulations and
- Infrastructure and support.

In the following paragraphs, each concept together with the list of indicators and data sources is described in detail.

7.1 Culture and institutions

7.1.1 Concept

Culture and institutions shape the foundation climate of entrepreneurship in a country and can be seen as catalysers of entrepreneurial activity.

According to North (1990) **institutions** are "the rules-of-the-game in a society, or more formally, the humanly devised constraints that shape human interactions. Institutions can be either formal rules — explicit, written documents such as laws and constitutions — or informal constraints, such as conventions and norms. In North's theory, formal rules are created by the polity, whereas informal norms are part of the heritage that we call culture" (Alesina & Giuliano, 2015).

The concept of **culture** encompasses the values, norms, interpretations and modes of behaviour that characterise societies or other social groups (Fukuyama, 2001). In this respect it is important to distinguish between the values and beliefs at the individual level and the entrepreneurial culture and norms that prevail in a country at the collective level (Hayton, George, & Zahra, 2002). Culture can relate to general aspects as trust, and individualism/collectivism or to more specific features related to entrepreneurship such as risk taking, respect for leadership, need for achievement, need for autonomy, locus of control and self-efficacy (Vecchio, 2003).

The cultural aspects at both the individual and collective level are **conductive for entrepreneurial activity** as they influence the attitudes and actual actions towards entrepreneurship. Recently, attitude surveys such as the Eurobarometer Survey (EC Eurobarometer, 2009) and the Global Entrepreneurship Monitor (Reynolds et al., 2005) have emerged to collect empirical data about the opinions, beliefs and attitudes towards entrepreneurship.

7.1.2 List of indicators

Entrepreneurship index

Regarding the entrepreneurial culture at the individual level, scholars advance that there is a direct relationship between positive personality traits towards entrepreneurship (e.g. **willingness to take risks**, the aspiration of being independent, the ability to recognise and **seize good opportunities**) and the decision to start-up a business (McMullen & Shepherd, 2006).

The propensity to create a company is also influenced at the collective level by the values and norms prevailing in the social environment in which individuals are living

(Davidsson & Wiklund, 1997; Etzioni, 1987). Hence, a positive opinion climate towards entrepreneurship in a country can encourage individuals to translate their entrepreneurial desirability into action. Alternatively, a negative entrepreneurial culture can act as a barrier to entrepreneurship (Helms, 2003). The collective opinion towards entrepreneurship can be measured with indicators capturing the **image of entrepreneurs** in society.

The list of indicators that measure the framework conditions on Culture and institutions in the Entrepreneurship index are presented in Table 1.

Table 1: List of indicators on Culture and institutions in the Entrepreneurship index

Culture & Institutions		
Indicator	Definition	Source
Opportunity recognition	The percentage of 18-64 population who see good opportunities to start a firm in the area where they live (survey)	GEM
Risk acceptance	The percentage of people who disagreed with the statement: "One should not start a business if there is a risk it might fail" (survey)	Eurobarometer
Image of entrepreneurs	The percentage of people having a favourable opinion about entrepreneurs (survey)	Eurobarometer

Scale-up index

The growth opportunities of firms extensively depend on framework conditions of Culture and institutions. One of the cultural aspects that can hamper daily activities of a company and eventually jeopardize its growth potential is the lack of trust. While trust creates a positive and productive attitude towards market exchange, the absence of it raises transaction costs due to suspicion and fear for fraud (Tabellini, 2010).

As the concept of trust is broad and multi-faceted, it can relate to different aspect of society: e.g. the general trust in people, the perceived **integrity of legal systems**, the trust in police and politics. More closely associated with the entrepreneurial activity, trust can also refer to the **willingness to delegate**. The fact of yielding the authority of an important management function to others is a crucial facilitator of growth. Empirical evidence shows that the willingness to devolve decision making and the involvement of other managers in the operational planning is significantly related to business growth as it allows the senior management to become more focused on strategic level decisions (Smallbone, Leig, & North, 1995).

Firms' growth can also be affected by the level of corruption in a country. Corruption is the abuse of public power or authority for private gains (Rodriguez, Siegel, Hillman, & Eden, 2006). It basically undermines the foundations of institutional trust that are essential for the development of entrepreneurial and innovative activity. In the presence of corruption, entrepreneurs can for example become increasingly reluctant to engage in innovation activities fearing the risk that the profits of their efforts are reaped by opportunistic and corrupt agents active in their value chain. In extreme cases it can completely block the entrepreneurial activities and lead to bankruptcy.

Corruption can lead to the wrong allocation of financial and human resources. This can be the case when managers obtain their position through relatives or friendship relationship rather than for their merits and qualifications. The former type of managers may lack the appropriate capabilities for successful decision-making. **Reliance on professional management** is a crucial prerequisite for firm growth.

The list of indicators that measure the framework conditions on Culture and institutions in the Scale-up index are presented in Table 2.

Table 2: List of indicators on Culture and institutions in the Scale-up index

Culture & Institutions		
Indicator	Definition	Source
Integrity of the legal system	Component based on the International Country Risk Guide's political risk component I for law and order. Two measures comprising on risk component: 1) strength and impartiality of legal system and 2) assessment of popular observance of the law	Economic Freedom of the World
Reliance on professional management	In your country, who holds senior management positions? [1 = usually relatives or friends without regard to merit; 7 = mostly professional managers chosen for merit and qualifications] (survey)	WEF
Willingness to delegate authority	In your country, how do you assess the willingness to delegate authority to subordinates? [1 = not willing at all—senior management takes all important decisions; 7 = very willing—authority is mostly delegated to business unit heads and other lower-level managers] (survey)	WEF

7.2 Access to human capital

7.2.1 Concept

The **access to human capital** comprises the access to "the stock of knowledge and skills that reside within individuals" (Wright, Hmieleski, Siegel, & Ensley, 2007). Hence, it does not only refer to the level of education of individuals but also to the training opportunities that they enjoy during their career path.

Human capital is seen as one of the most important drivers for entrepreneurship and remains important all along the entrepreneurial life-cycle. First, human capital is vital for the formation of entrepreneurial activity as it provides the ability to recognise and grasp the right opportunities and to develop them into more elaborated business concepts (Alvarez & Barney, 2007; Marvel, 2013). Second, it positively influence venture performance as it provides the requested capabilities for the daily operations of firms such as problem-solving and decision-making qualities (see also previous section) (Chandler & Hanks, 1994). Third, it allows for the accumulation of new knowledge and the discovery and development of competitive opportunities (see also next section) (Corbett, Neck, & DeTienne, 2007).

7.2.2 List of indicators

Entrepreneurship index

High-quality human capital is vitally important for nascent entrepreneurship. It constitutes the pool of prospective entrepreneurs and provides the stock for recruitment of new workforces. The **quality of human capital** is commonly captured by levels of education of the active population.

In the past decades, **Entrepreneurship education and training** (EET) has received increasing attention from policy makers and has grown into an established field of study. EET is a crucial means to provide individuals with the entrepreneurial mindsets and skills and aims to support entrepreneurial activities. Prospective entrepreneurs with a higher level of entrepreneurship education have a greater ability to identify opportunities and hence are more likely to engage in entrepreneurial activity (Davidsson & Honig, 2003).

To nurture entrepreneurship, EET initiatives have been incorporated in various policy programs. EET has been identified as an important objective of the Flagship Initiative 'Innovation Union' in the Europe 2020 Strategy (EC, 2010) and it constitutes a key priority of the Strategic Framework for European Cooperation in Education and Training up to 2020 (ET2020).²

² A [joint report](#) of the Council and the Commission has proposed six new priorities for European cooperation in education and training for 2016-2020, including entrepreneurship education and training.

The list of indicators that measure the framework conditions on Access to human capital in the Entrepreneurship index are presented in Table 3.

Table 3: List of indicators on Access to human capital in the Entrepreneurship index

Access to human capital		
Indicator	Definition	Source
Tertiary education	Gross enrollment ratio in tertiary education as share of active population	Eurostat
Entrepreneurship education during lower education	The extent to which training in creating or managing SMEs is incorporated within the education and training system at primary and secondary levels (survey)	GEM
Entrepreneurship education during higher education	The extent to which training in creating or managing SMEs is incorporated within the education and training system in higher education such as vocational, college, business schools (survey)	GEM

Scale-up index

The availability of **managerial and technical capabilities** on the labour market is an important determinant for firm growth. First, managerial capabilities are indispensable for the operational and strategic planning and the organisational changes that come along the growth processes of firms. Second, technical capabilities are needed for the discovery and the development of new ideas and technologies.

Continuous entrepreneurship education and training is also essential for the growth potential of firms. The firms' (innovative) performance depends heavily on the employees' knowledge and capabilities. **Continuous staff training** and development opportunities during the entire career path allow employees to strengthen their capabilities where needed and to remain aware of the cutting edge technologies and practices in their industry.

The list of indicators that measure the framework conditions on Access to human capital in the Scale-up index are presented in Table 4.

Table 4: List of indicators on Access to human capital in the Scale-up index

Access to human capital		
Indicator	Definition	Source
Availability of managerial and technical capabilities on the labour market	The percentage of the active population in managerial and technical occupations	ILO
Quality of management schools	The quality of management schools across countries is (limited or of poor quality for 1, to amongst the best in the world for 7) (survey)	WEF
Staff training	To what extent do companies in your country invest in training and employee development? (1 = hardly at all; 7 = to a great extent) (survey)	WEF

7.3 Creation of knowledge and networking

7.3.1 Concept

The **creation of knowledge** involves the various activities related to the conceptualisation, the development and the protection of new products and services. The discovery process of new opportunities is facilitated through firms' research and development efforts. The resulting innovations have been widely recognised among economists as important drivers of economic development and prosperity (Aghion & Howitt, 1992; Griliches, 1979; Romer, 1990).

The concept of **networking** relates to the "open innovation" paradigm that was originally advanced by Chesbrough (2003) to describe the externalisation of innovation processes. In the last decades, firms shifted from closed or in-house R&D efforts towards

the combination of internal and external knowledge and technologies to develop and commercialize new products or services on the market. It implies the access to and the acquisition of technologies and knowledge from external sources through e.g. R&D contracts, licensing inter-organizational partnerships and strategic alliances.

7.3.2 List of indicators

Entrepreneurship index

The development of new goods and services is a long-term process that goes along with multiple feed-back loops, implying that the first years of business activity are often devoted to the designing, prototyping, testing and demonstration of new goods and services. Hence, corporate activities in start-ups are often directed to **research and development** in order to come up with a scalable product or service that can be commercialized on the market.

In order to facilitate firms in consolidating their market position and to allow them to appropriate the benefits of their R&D efforts, **intellectual property rights** have been created through patents, copyrights and trademarks. These rights protect the innovative firms for a specific period of time and prevent competitors of stealing their novel ideas and concepts. At that moment the ability to turn the R&D efforts into successful **product and process innovations** is vital to maintain a competitive advantage and to secure the firms' survival in the early stage of business (Brüderl, Preisendörfer, & Ziegler, 1992; Wagner, 1999). Empirical evidence shows that innovative firms (where innovation is proxied by patent stocks and trademarks) are more likely to survive (Buddelmeyer, Jensen, & Webster, 2010; Helmers & Rogers, 2010). Disentangling the survival effects across different types of innovations reveals that firms introducing process innovations have a higher survival probability (Cefis & Marsili, 2005; Colombelli, Krafft, & Vivarelli, 2016).

The list of indicators that measure the framework conditions on Creation of knowledge and networking in the Entrepreneurship index are presented in Table 5.

Table 5: List of indicators on Creation of knowledge and networking in the Entrepreneurship index

Creation of knowledge and networking		
Indicator	Definition	Source
R&D expenditure	Business expenditure on R&D (BERD) as a percentage of GDP in PPS	Eurostat
Intellectual property right	Intellectual property protection in the world (1 = is weak or nonexistent, 7 = is equal to the world's most stringent) (survey)	WEF
Patents	Number of patents per GDP in PPP	Eurostat
Product and process innovations	Share of firms with product and/or process innovations	CIS

Scale-up index

In an attempt to reach higher growth levels, an increasing number of firms adopted open innovation strategies. The advantages are numerous. First, it ensures firms the access to knowledge and complementary assets that they do not possess in-house (Hagedoorn, 1993; Teece, 1986). Second, conducting research and development with external partners allows creating and mobilizing more resources than would be possible through individual efforts (Das & Teng, 2000). In addition, licensing and R&D contracts help to avoid the often lengthy and tedious in-house R&D process, while collaborations strategies allow for sharing the R&D costs among different partners (Hagedoorn, 2002; Veugelers, 1998). Overall, it reduces the risks associated with the R&D-intensive

innovation projects, but requires enough internal R&D knowledge from the firms to understand, assimilate and exploit the accessed or acquired external technology (Cohen & Levinthal, 1990).

A large strand of prior research has highlighted the importance of the various open innovation strategies for firm growth. Empirical evidence demonstrates the direct and positive impact of licensing and R&D collaborations on firm performances in terms of productivity and market value (Belderbos, Carree, & Lokshin, 2004; Hung & Chou, 2013) or indirectly through a positive impact on innovation performance (Faems, Van Looy, & Debackere, 2005).

Increasingly, open innovation is seen as a real need rather than an optional strategy to achieve high-end growth, especially for small and medium sized firms (Brown, Mason, & Mawson, 2014; Lichtenthaler, 2011). SMEs are often impeded in their growth due to factors that are inherent to their firm size. Hence, new product and service developments with in-house R&D investments may be hindered by the typical resource constraints of smaller firms such as the lack of managerial capacity, human skills, financial resources or laboratory facilities. To overcome these barriers to growth, SMEs increasingly resort to open innovation practices by exploiting opportunities for partnerships and accessing external firm resources and technologies.

Collaboration strategies can take different forms and may involve various types of partners: firms, universities and customers, among others. **Collaboration among firms** enables them to work together to achieve a defined and common business purpose. **University-industry collaborations** allow merging basic and applied research. Close alliances with university researchers provide industry scientists the opportunity to gain better understanding in the science that underlies the innovative discovery. **Collaboration with customers** aims to prioritise customer engagement. Social media is increasingly used as a tool to collect customer feedback and to shape firm strategies along the current needs and experiences of their customers. Finally, collaboration initiatives do not remain confined within country borders. Further promotion of **international collaboration** is one of the key commitments mentioned in the Europe 2020 Flagship Initiative Innovation Union.³

The list of indicators that measure the framework conditions on Creation of knowledge and networking in the Scale-up index are presented in Table 6.

Table 6: List of indicators on Creation of knowledge and networking in the Scale-up index

Creation of knowledge and networking		
Indicator	Definition	Source
Collaboration with other firms	The percentage of innovative enterprises collaborating with competitors or other enterprises of the same sector (survey)	CIS
Collaboration with customers	The percentage of innovative enterprises collaborating with clients or customers from the private sector (survey)	CIS
University-industry collaboration	The percentage of innovative enterprises collaborating with universities or other higher education institutions (survey)	CIS
International collaboration	The percentage of enterprises engaged in any type of innovation collaboration with a partner in EU countries, EFTA or EU candidates countries (except a national partner) (survey)	CIS

³ For more information about the Europe 2020 Flagship Initiative Innovation Union: https://ec.europa.eu/research/innovation-union/pdf/innovation-union-communication-brochure_en.pdf

7.4 Market conditions

7.4.1 Concept

Market conditions encompass the characteristics of a market into which entrepreneurs are operating. Hence, they constitute one of the most important aspects of entrepreneurship ecosystems. They include the market value of final goods and services produced, the level of competition, the access to domestic and foreign markets, among others. Undoubtedly, the impact of market conditions varies along the phases of the entrepreneurial life-cycle diverging for start-up and scale-up firms.

7.4.2 List of indicators

Entrepreneurship index

The nature of the market structure and in particular the market potential can trigger the creation of firms in various ways. Entrepreneurs can respond to opportunities in (new) markets or can be triggered by the increase of demand and supply or by high levels of innovations activities (Carree & Thurik, 2000; Klepper, 2002). High market dynamics are often characterised with lower levels of competition which makes it more attractive for firms to enter the market. The **internal market openness** or the extent to which firms are free to enter the market is a crucial factor to nurture emerging entrepreneurial activities. However, market dynamics can be hampered by a high **degree of market dominance**. Entrepreneurs may be less likely and willing to enter a market that is dominated by powerful businesses possessing large shares of the market.

Another challenging aspect that may prevent entrepreneurs from entering is the health of the labour market. The **level of unemployment** does not only provide information about the labour market, but is often seen as a good indicator of the general conditions in the market. High levels of unemployment indicate a lack of economic strength in the country and can lead to lower firm entries as entrepreneurial initiatives may be postponed or even aborted.

Although a wide range of micro-economic studies have found a negative effect of unemployment on firm births (Audretsch & Fritsch, 1994; Reynolds, Miller, & Maki, 1995; Ritsilä & Tervo, 2002), other studies indicate a positive effect (Carree & Thurik, 1996; Lee, Florida, & Acs, 2004). The mixed evidence can be explained by the complexity of market dynamics and the variety of motivations driving individuals towards entrepreneurship. High unemployment rates may for example stimulate individuals to become self-employed (often referred to as the "unemployment push" hypothesis). Higher entrepreneurial activity based on this argument may lead to a reduction of unemployment in subsequent periods. Higher competition due to new firm entry may in turn lead to more firm exits in the short run and increase unemployment (Fritsch & Mueller, 2004). However, at the aggregated country level, the unemployment rate is generally assumed to have a negative impact on the firm birth rate.

The list of indicators that measure the framework conditions on Market conditions in the Entrepreneurship index are presented in Table 7.

Table 7: List of indicators on Market conditions in the Entrepreneurship index

Markets conditions		
Indicator	Definition	Source
Market dominance	Extent of market dominance: "Corporate activity in your country is (1 = dominated by a few business groups, 7 = spread among many firms)" (survey)	WEF
Unemployment	Unemployment rate	Eurostat
Internal market openness	The extent to which new firms are free to enter existing markets (survey)	GEM

Scale-up index

Firm growth is also affected by market conditions. The growth potential of a firm is extensively dependent on the **size of the market**. The size and effectiveness of a domestic market is to a large extent influenced by the presence of foreign firms. A large strand of literature has investigated the growth performance of domestic firms due to technology transfers stemming from foreign firms in the market. Technology transfers can occur through different transmission channels (Blomström & Kokko, 1998; Görg & Greenaway, 2004). First, domestic firms can observe and imitate the technologic advanced production methods of foreign owned affiliates. Second, local firms can benefit from transfers of knowledge and technology by attracting high skilled employees from multinationals (Fosfuri, Motta, & Rønde, 2001). Third, the entrance of multinationals may also reinforce competition within the sector and encourage domestic firms to become more efficient (Glass & Saggi, 1998). Finally, domestic firms may gain access to import products of better quality through their linkages with foreign affiliates.

For these reasons, it is important to account for the **foreign competition** in the market. The indicator of foreign competition in the Global competitiveness index includes the following dimensions: prevalence of foreign ownership, prevalence of trade barriers, trade tariffs, import as percentage of GDP, business impact of rules on FDI and burden of customs procedures.

Domestic markets in the European Member States are often too restricted to allow firms to expand to their full potential, forcing them to extend the scope of their activities beyond national borders. Internationalisation is often cited as an important channel for firm growth. However, Brown et al. (2014) emphasize that high-growth firms do not restrict themselves to export activities, but use a wide range of means to expand to foreign markets such as joint ventures, overseas **foreign direct investments** (FDI) and licensing. The rather scant literature analysing the market expansion strategies of high-growth firms, reveals that high-growth firms are significantly more internationalised compared to non high-growth firms and that they use various mechanisms for market expansion (Brown & Mawson, 2016; Bürgel, Fier, Licht, & Murray, 2004). Encouraged by the rapid development of the digital economy, **cross-border e-commerce** became a mainstream and efficient method for the internationalisation of goods and services.

The list of indicators that measure the framework conditions on Market conditions in the Entrepreneurship index are presented in Table 8.

Table 8: List of indicators on Market conditions in the Scale-up index

Markets conditions		
Indicator	Definition	Source
Market size	GNI per capita, PPP (constant 2011 international \$)	World Bank
Foreign competition	Foreign competition variable used in the Global Competitiveness Index	WEF
Cross-border e-commerce	The percentage of individuals buying goods or services over the internet from sellers from other EU countries in the last 12 months	Eurostat
Foreign direct investment	Outward foreign direct investment stock as percentage of GDP	OECD

7.5 Access to finance

7.5.1 Concept

Scholars commonly assert that **access to finance** is one of the most important framework conditions as the lack of finance impedes firms all along the development process. The failure to raise capital can hinder essential investments at the start-up, or can jeopardize the firms' survival during its search for a scalable business model. Finally, financial shortage may hamper firms in their growth ambition by preventing them from investing in promising innovative projects. Typical examples of entrepreneurial finance are debt financing in the form of bank loans or equity finance in the form of venture capital or stocks. The sources and types of finance that firms are using vary extensively along the different milestones entrepreneurs are trying to achieve.

7.5.2 List of indicators

Entrepreneurship index

In an attempt to avoid the leakage of new ideas and knowledge to external sources, the vast majority of the entrepreneurs of start-up companies are relying on own funds or savings or obtain financial assistance of family and friends (OECD & EC, 2014). Given that self-financing and personal network funds are often not sufficient to cover the financial needs of new business ventures, entrepreneurs are forced to rely on other funding sources such as bank loans. Although bank loans are common practice among firms in raising funding, particularly start-ups may face difficulties in obtaining it due to information asymmetries (Beck & Demirguc-Kunt, 2006). These asymmetries arise from the fact that banks often lack sufficient skills and information to judge the viability of a business project. In addition, since start-ups have less fixed assets than larger firms that can serve as collateral for bank loans, their capital request are more likely to be rejected.

Subsequently, start-ups are searching for alternative ways of financing. Abovementioned financing methods are increasingly supplemented by **seed and first stage VC funding** and private investments of business angels (Nepelski, Piroli, & De Prato, 2016; OECD, 2016). In these cases the problems related to asymmetric information are mitigated since **business angels** and venture capitalists often possess more specialised evaluation skills than bank lenders (Lee, Sameen, & Cowling, 2015). In addition to providing finance, business angels are also sources of business advice, mentoring and professional networks. More recently **alternative forms of finance** have emerged to help start-ups alleviating the constraints of funding gaps such as microcredits, crowdfunding, and peer-to-peer lending (Bruton, Khavul, Siegel, & Wright, 2015).

The list of indicators that measure the framework conditions on Access to finance in the Entrepreneurship index are presented in Table 9.

Table 9: List of indicators on Access to finance in the Entrepreneurship index

Access to finance		
Indicator	Definition	Source
Seed and first-stage VC funding	Amount of seed and first stage VC funding (€ thousands) per GDP in PPP	Dow Jones
Business angels	Number of business angels per GDP in PPP	European Trade Association for Business Angels
Alternative finance	Alternative finance volume (€ thousands) per capita	Global Alternative Finance Data Depository

Scale-up index

More established firms gain in recognition and reputation on the market place over time, which decreases the asymmetric information with external investors when accessing funding. Especially high-growth may have more facility in accessing domestic bank credit. Besides **bank credit to the private sector**, established firms continuously rely on venture capital. The **ease of access to venture capital** and in particular **second and later stage VC funding** are crucial means to support and generate entrepreneurial growth. Empirical studies have shown a positive link between VC-backing and a wide range of metrics measuring growth rates in revenues, employment, and productivity (Grilli & Murtinu, 2014; Manigart & Wright, 2013; Puri & Zarutskie, 2012).

The positive impact of VC on firm growth has several reasons. First, a large fraction of venture capitalists select high growth industries. In general, VC investors are better able to screen firms with a high potential than other capital market operators (Rosenbusch, Brinckmann, & Müller, 2013). Second, venture capitalists – in contrast to banks – do not confine themselves to a passive monitoring of firms' results, but do actively provide value-creating managerial skills and competences to the firms in their portfolio (Fraser, Bhaumik, & Wright, 2015). Third, the VC endorsement acts as reputation effect. It provides VC backed firms a "quality stamp", allowing them to get access to external resources and networks that would have remained out of reach without this endorsement (Hochberg, Ljungqvist, & Lu, 2007; Hsu, 2006).

In need for large amounts of capital to finance their market expansion strategies, growth-oriented firms are typically relying on public investors through **initial public offerings** on stock exchange markets. Hence, the **ease of access to the equity market** is recognised as an important catalyser for firm growth.

The list of indicators that measure the framework conditions on Access to finance in the Scale-up index are presented in Table 10.

Table 10: List of indicators on Access to finance in the Scale-up index

Access to finance		
Indicator	Definition	Source
Bank credit to private sector	Domestic credit to private sector by banks (% of GDP): the indicator refers to financial resources provided to the private sector - such as through loans, purchases of non-equity securities, and trade credits and other accounts receivable - that establish a claim for repayment	IMF
Ease of access to venture capital	In your country, how easy is it for entrepreneurs with innovative but risky projects to find venture capital? [1 = extremely difficult; 7 = extremely easy] (survey)	WEF
Second and later stage VC funding	Amount of second and later-stage funding raised (€ thousands) per capita	Dow Jones
Ease of access to equity market	In your country, how easy is it for companies to raise money by issuing shares on the stock market? [1 = extremely difficult; 7 = extremely easy]	WEF
Finance through equity markets	Number of IPOs per GDP in PPP	Zephyr database (Bureau Van Dijk)

7.6 Tax and regulations

7.6.1 Concept

The term **tax and regulations** reflects the fiscal and regulatory environment that is in place in national systems. The fiscal and regulatory environment is often seen as a barrier for entrepreneurial entry and growth. One of the most referred initiatives to collect data about national regulatory frameworks is the World Bank "Ease of Doing Business" database (World Bank, 2016). It provides detailed information about regulatory obstacles to firms and helps policy makers in identifying the needs for improving the quality and the efficiency of regulations.

7.6.2 List of indicators

Entrepreneurship index

The entry rate of start-ups firms can be severely hampered due to the cumbersome administrative procedures of creation a new business. It can happen that entrepreneurs abort their business activities due to the fact that the opportunity of launching a new and successful product or services on the market is passed by the time the firm complies to the complex and often unnecessary lengthy regulatory procedures. The regulatory obstacles for business entry can include: **the number of procedures required to register a new business**, minimum capital requirement for new limited liability companies; **the number of days required to complete a new business registration**, among others.

The list of indicators that measure the framework conditions on Market conditions in the Entrepreneurship index are presented in Table 11.

Table 11: List of indicators on Tax and regulations in the Entrepreneurship index

Tax and regulations		
Indicator	Definition	Source
Number of days for starting a business	The average time spent during each enterprise start-up procedure	World Bank
Number of procedures for starting a business	The number of generic procedures that are officially required for an entrepreneur to start an industrial or commercial business	World Bank

Scale-up index

Regulations can also hamper the daily operations of a firm and impact on the growth potential. Typical regulations related to daily operations include: **the process of hiring and firing** labour forces and **regulations concerning tax payments** and product market regulations. Recently, favourable fiscal policies in the form of R&D tax incentives have been set up to encourage innovation activities and future firm growth (Henrekson & Davidsson, 2002).⁴

The list of indicators that measure the framework conditions on Market conditions in the Entrepreneurship index are presented in Table 12.

Table 12: List of indicators on Tax and regulations in the Scale-up index

Tax and regulations		
Indicator	Definition	Source
Time spent on tax issues	Time to prepare and pay taxes is the time, in hours per year	World Bank
Hiring and firing regulations	In your country, how would you characterize the hiring and firing of workers? [1 = heavily impeded by regulations; 7 = extremely flexible] (survey)	WEF
Burden of government regulation	In your country, how burdensome is it for businesses to comply with governmental administrative requirements (e.g., permits, regulations, reporting)? [1 = extremely burdensome; 7 = not burdensome at all] (survey)	WEF

⁴ R&D tax incentives have been considered as indicator for the framework conditions on Tax and regulations of the Scale-up index, but were ultimately not included due to low correlations with the other indicators in the pillar.

7.7 Infrastructure and support

7.7.1 Concept

The last factor that comprises framework conditions of entrepreneurship ecosystems is **infrastructure and support**. It encompasses the infrastructure and the support mechanisms that are essential for the creation and the daily operations of firms (Hansen & Sebora, 2003).

7.7.2 List of indicators

Entrepreneurship index

A commonly cited support initiative in place to encourage the start-up of new firms is the business incubator. Business incubators generally provide access to office space and basic equipment, allowing start-ups to avoid the operating costs of the business settlement (Albort-Morant & Oghazi, 2016; Allen & Rahman, 1985). Besides helping start-ups on saving operating costs, business incubators also provide advisory support through business and management training and offer financial and legal assistance. In addition it provides the access to professional networks and hence it facilitates the transfer of knowledge between the new business ventures and other partners. Hence, incubators contribute extensively to the business stability of new ventures (Schwartz & Hornyh, 2008). At the time of writing no indicators on business incubators could be identified that satisfy the data needs of the index (i.e. sufficient coverage in terms of Member States and annually updated).

A large strand of macro-economic literature has analysed the role of physical infrastructure in terms of transport facilities (e.g. highways and trains). In general, these empirical studies find a positive relationship between the country/state infrastructure and its economic growth (Banister & Berechman, 2001). However, the literature with a specific focus on the link between entrepreneurship and physical infrastructure remains rather scarce. Audretsch et al. (2015) is one of the only studies analysing this issue. Infrastructure is found to be positively associated with start-up activity. A good **quality of infrastructure** and a decent **performance of logistic services** are essential to ensure the logistics towards clients and suppliers. While most high-income countries have well established transport facilities, it remains a major concern for transition economies (Bitzenis & Nito, 2005).

The list of indicators that measure the framework conditions on Infrastructure and support in the Entrepreneurship index are presented in Table 13.

Table 13: List of indicators on Infrastructure and support in the Entrepreneurship index

Infrastructure and supports		
Indicator	Definition	Source
Logistics index	Logistics performance index: Overall (1=low to 5=high)	World Bank
Quality of infrastructure	Quality of overall infrastructure, 1-7 (best)	WEF

Scale-up index

Given that we are increasingly moving towards a digital society, many scholars have measured the impact of digital infrastructure on economic growth (Czernich, Falck, Kretschmer, & Woessmann, 2011; Koutroumpis, 2009). Czernich et al (2011) stipulate that the digital infrastructure "facilitates macroeconomic growth by accelerating the distribution of ideas and information, fostering competition for and development of new products and processes, and facilitating the introduction of new work practices,

entrepreneurial activities and improved job matching". The digital infrastructure can be measured with indicators such as the **broadband access, the use of ERP packages or the percentage of firms employing e-commerce.**

The list of indicators that measure the framework conditions on Infrastructure and support in the Scale-up index are presented in Table 14.

Table 14: List of indicators on Infrastructure and support in the Scale-up index

Infrastructure and supports		
Indicator	Definition	Source
E-commerce	The percentage of firms having received orders via computer mediated networks	Eurostat
Use of ERP packages	The percentage of firms who have ERP software package to share information between different functional areas	Eurostat
Broadband access	Fixed (wired) broadband subscriptions (as percentage of population)	Eurostat

8 Statistical methodology

The methodology for constructing ESIS follows the various methodological steps highlighted by the OECD/JRC handbook on composite indicators (OECD & JRC, 2008). This section extensively builds on the expertise of the Competence Centre on Composite Indicators and Scoreboards of the Joint Research Centre in Ispra.⁵

In particular, the construction of ESIS can be outlined in the following key steps that will be discussed in more detail in this section:

Step 1 - Data coverage: quality assessment of the raw data in terms of data availability and data imputation decisions;

Step 2 - Outlier treatment: identification and replacement of outliers in the raw data;

Step 3 - Normalisation method: selection of a suitable normalisation method in order to adjust the raw data to a notionally common scale;

Step 4 - Aggregation method: selection of a suitable aggregation method allowing or not for compensability among indicators;

Step 5 - Weighting method: selection of a suitable weighting method favouring equal weighting or not;

Step 6 - Correlation and principal component analysis: assessment of the statistical coherence in terms of the underlying importance of indicators and sub-dimensions;

Step 7 - Impact of modelling assumptions: uncertainty and sensitivity analyses to assess the robustness of ESIS.

8.1 Data coverage

Both the entrepreneurship and scale-up composite indices are calculated for the EU28 countries and the EU28 average. Most of the data that feed the indicators is obtained from publicly available databases that are annually updated. As many databases are lagging one or two years behind in making data publicly available, indicators are collected - where possible - for the year 2014. In a few cases of missing values for the GEM data, indicators are imputed with the values of the closest available years, or as an average of 2013 and 2015. For reasons of transparency and replicability, we chose not to estimate data for countries lacking indicator values for all years. To reflect the uncertainty in rankings due to missing data simulation analyses have been conducted in section 8.7 with imputed data.

Entrepreneurship index

Overall the number of missing values for the indicators feeding the start-up index remains relatively low (5.96 percent). The pillars on Culture and institutions, Creation of knowledge and networking and Market conditions have missing values for Cyprus and Malta as these countries are not covered by the Global Entrepreneurship Monitor. The majority of missing data is concentrated in the pillar of Access to finance. The indicators on the number of business angels and alternative finance contain respectively 27.59 and 55.17 percent of missing values.

The decision not to impute missing data implies that missing values are replaced with the average of the available data of the other indicators within the pillar. This means that the pillar on Access to finance will be mostly driven by the indicator on the amount of VC funding in the seed and first stage. At the moment of writing this report we are

⁵ For more information about the construction and audit of composite indicators, we refer to the Competence Centre on Composite Indicators and Scoreboards: <https://ec.europa.eu/jrc/en/coin>.

still waiting for additional data on alternative finance covering the missing countries. The next version of the entrepreneurship index will contain this updated data and hence will have a better data coverage (above 97 percent).

Scale-up index

The scale-up index has an excellent data coverage exceeding 98 percent. Most of the missing values are situated in the pillar of Market conditions. Values are missing for respectively 3 and 7 countries in the indicators of GNI per capita and foreign direct investment. Given the limited amount of missing data in the scale-up index, the impact of imputed data on the country ranking remains limited (see section 8.7).

8.2 Outlier treatment

The presence of outliers may result in inappropriate benchmarks and must therefore be dealt with before the indices can be constructed. Potentially problematic values that could bias the overall results of the indices are trimmed. Positive outliers are identified as country values exceeding the mean across all countries plus two times the standard deviation. Negative outliers are identified as country values which are smaller than the mean across all countries minus two times the standard deviation. These outliers are replaced by the respective maximum and minimum values observed after exclusion of the outliers. Following this method, the indicators of the entrepreneurship and scale-up index have been trimmed up to a respective maximum of two and three values per indicator. As such, the data distribution of each indicator remains with an acceptable range of skewness (lower than 2 in absolute terms) and kurtosis (lower than 3.5 in absolute terms).⁶

8.3 Normalisation method

The indicators are expressed in different units (percentages, number of days, and other), have different ranges and variances, and thus a normalisation to a common scale is required. The methods that are most frequently used are standardisation (or z-scores) and re-scaling.

Standardisation: $\frac{x_i - \text{mean}(x)}{\text{std}(x)}$

This method converts the indicators to a common scale of mean zero and standard deviation of one. Therefore it rewards exceptional behavior, i.e. above-average performance of a given indicator yields higher scores than consistent average scores across all indicators.

Re-scaling: $\frac{x_i - \min(x)}{\max(x) - \min(x)}$

The re-scaling method normalises indicators to an identical range [0,1] where higher scores represent better achievement. While this latter method may be easier to communicate to a wider public, it does not preserve the variance of the data and it is highly sensitive to outliers. Therefore we use the standardization method to normalise the indicators.

After normalisation, we take into account the direction of the indicators, meaning that all indicators should be expressed in a way that a higher value corresponds to a better performance. As such, all normalised indicators that cannot be interpreted in this way

⁶ Based on Groeneveld and Meeden (1984) which sets the criteria of absolute skewness above 1 and kurtosis above 3.5. The skewness criterion was relaxed to account for the small sample at hand (29 economies).

and for which a directional adjustment is needed (e.g. unemployment rate, number of days to start a business) are multiplied by -1.

8.4 Aggregation method

For the aggregation of indicators into pillars and indices, we use arithmetic averages as is traditionally used in most of the well-known indices in the international scene. Aggregation with arithmetic averages has the virtue of being simple but encounters several shortcomings that may challenge the use of this method (Saisana & Saltelli, 2014). Some counter arguments for the use of arithmetic means are: (a) perfect substitutability, i.e. poor performance in one indicator can be fully compensated by good performance in another, (b) no reward for balance: the arithmetic mean does not penalize the differences in values between indicators, i.e. it does not reward balanced achievement in all indicators, (c) no impact of poor performance: the arithmetic mean does not consider that the lower the performance in a particular indicator, the more urgent it becomes to improve achievements in that indicator.

To overcome these shortcomings other aggregation methods such as the geometric mean have been advanced by practitioners (Munda, 2008). This average method is a partially compensatory approach that rewards economies with balanced profiles and motivates them to improve in the dimensions in which they perform poorly, and not just in any dimension. To explore the uncertainty of the index due to geometric averages, we conduct analyses with this alternative aggregation method in section 8.7.

8.5 Weighting method

For the construction of ESIS, indicators are first aggregated at pillar level (i.e. indicators of one framework condition are aggregated together). Subsequently, the different pillars or framework condition scores are aggregated to obtain the final indices. Aggregation of the pillars into the index has first been tested with equal weights for both indices (i.e. a weight of 1/7 for each pillar). Correlation analyses between the index and pillar scores have been used to determine the validation of equal weighting. Equal weighting is justified in case of a balanced contribution of the pillars to the variance of the index. Exhibiting a balanced profile, the pillars of the Entrepreneurship have been aggregated with an equal weighting method. Most of the pillars of the Scale-up index are balanced, except for the pillar on Creation of knowledge and networking. Hence, this pillar has received half of the weight of the most influential pillar (i.e. pillar on Culture and institutions) while other pillars remain equally weighted. Correlation analyses between the index and the pillars are explained more in detail in the next section.

8.6 Correlation and principal component analysis

In order to assess the statistical and conceptual coherence of the structure of the data and the underlying indicators that populate the indices, we conduct preliminary correlation analyses within and across pillars. Overall, indicators need to be sufficiently (above 0.3) but not excessively (below 0.95) correlated to have a statistical justification for aggregating them within a pillar. In addition, Principal Component Analysis (PCA) is used to assess to what extent the conceptual framework is confirmed by statistical approaches and to identify eventual pitfalls.

Entrepreneurship index

The statistical dimensionality and the grouping of indicators into pillars is primarily analysed through correlation analyses. Correlations within and across pillars are

presented in Table 15. The analyses lead us to the following conclusions. First, we find considerably strong correlations between indicators within a pillar and between the indicators and their corresponding pillar. This suggests that indicators provide meaningful information on the variation of the pillar scores. Second, the correlations between the indicators and their pillars are strongly balanced, pointing at the equal importance of the indicators within the pillar.

Third, the importance of the pillars within the final index remains relatively balanced, except for the pillar on Tax and regulations that report a lower correlation level (0.39). Overall, this pillar does not seem to correlate much with the other pillars that populate the index. This means that this particular pillar will contribute less than the other pillars to the explanation of the country rankings. In fact, the pillar on Tax and regulations account for 15% of the variation of the entrepreneurship index score, while for instance the pillar on Culture and institutions accounts for 72%.⁷

Finally, additional correlation analyses (not reported here) confirm the expectation that indicators are more correlated within their own pillar than with any other pillar. Hence, no re-allocation of indicators to other pillars is needed.

Principal component analysis confirms the presence of a single latent dimension in each of the seven pillars (one component with eigenvalue greater than 1.0) that captures between 55% (pillar of Access to finance) up to 82% (pillar on Infrastructure and supports) of the total variance in the underlying indicators. The relatively low variance explained by the first latent dimension in the pillar of Access to finance is not surprising given the high amount of missing data in the pillar (25%).

⁷ In this case, the amount of variance explained by a pillar is equal to the squared value of the Pearson correlation coefficient between the pillar and the entrepreneurship index.

Table 15: Correlations within and across pillars and the Entrepreneurship index

Correlations within pillars									
Pillar and indicators	1	2	3	4					
1 Culture and institutions	1.000								
2 Opportunity recognition	0.816	1.000							
3 Risk acceptance	0.750	0.368	1.000						
4 Image of entrepreneurs	0.828	0.581	0.401	1.000					
Pillar and indicators	1	2	3	4	5				
1 Creation of knowledge	1.000								
2 Business R&D expenditure	0.900	1.000							
3 IPR	0.874	0.644	1.000						
4 Patents	0.913	0.882	0.689	1.000					
5 Product & process innov.	0.885	0.704	0.797	0.692	1.000				
Pillar and indicators	1	2	3	4					
1 Access to finance	1.000								
2 Amount VC seed funding	0.901	1.000							
3 Business angels	0.878	0.640	1.000						
4 Alternative finance	0.809	0.526	0.467	1.000					
Pillar and indicators	1	2	3						
1 Infrastructure	1.000								
2 Logistics performance	0.905	1.000							
3 Quality infrastructure	0.905	0.639	1.000						
Correlations across pillars and index									
Index and pillars	1	2	3	4	5	6	7	8	
1 Entrepreneurship Index	1.000								
2 Culture and institutions	0.853	1.000							
3 Access to human capital	0.710	0.588	1.000						
4 Creation of knowledge	0.834	0.718	0.342	1.000					
5 Market conditions	0.643	0.569	0.338	0.667	1.000				
6 Access to finance	0.722	0.584	0.634	0.428	0.151	1.000			
7 Tax and regulations	0.393	0.120	0.361	0.075	-0.070	0.367	1.000		
8 Infrastructure	0.825	0.688	0.360	0.860	0.572	0.448	0.115	1.000	

Note: For reasons of readability several names of pillars and indicators have been abbreviated. Correlations between indicators and pillars or pillars and the entrepreneurship index are indicated in bold.

Calculations: EC JRC.

Scale-up index

Similar correlation and principal component analyses have been conducted for the scale-up index. Correlations within and across pillars are presented in Table 16. To avoid double counting problems due to high correlations and due to excessive dominance in the variation of their respective pillars, several pairs of indicators are treated as a single indicator. This is done by allocating a weight of 0.5 to each indicator in the following pairs: Willingness to delegate authority – Reliance on professional management, Availability of managerial and technical occupations in the labour market – Staff training, Cooperation with other firms – Cooperation with customers.

Similar conclusions can be drawn from the correlation tables within pillars:

- The conceptual framework receives statistical justification for the aggregation of indicators into their respective pillars given the strong correlations between indicators.
- The analyses reveal equal importance of indicators within their respective pillars as indicated by the strongly balanced correlations between indicators and the pillar scores.

Principal component analysis also confirms for the scale-up index the presence of a single latent dimension in each of the seven pillars that captures between 59% (pillar of Access to finance) up to 88% (pillar on Culture and institutions) of the total variance in the underlying indicators.

The correlation analyses across pillars and the final index reveal some imbalances. While the pillars on Culture and institutions, Access to human capital, Market conditions, and Access to finance are strongly related to the index (i.e. accounting for approximately 72% to 82% of the variance of the index), the importance of the pillars on Tax and regulations and Infrastructure and support is slightly lower (i.e. explaining approximately 50% and 64% of the variance). In comparison to these pillars, the importance of the pillar on Creation of knowledge and networking is relatively weak as it contributes only to 18% of the index variance. In case of equal weighting the importance of this latter pillar would be even lower. Hence, to partially compensate for this imbalance we allocated half of the weight of the most influencing pillar (i.e. the pillar on Culture and institutions) to this pillar.

Table 16: Correlations within and across pillars and the Scale-up index

Correlations within pillars											
Pillar and indicators					Pillar and indicators						
	1	2	3	4		1	2	3	4		
1 Culture and institutions	1.000				1 Access to human capital	1.000					
2 Integrity of legal system	0.950	1.000			2 Perc. of Manag&Tech occupations	0.831	1.000				
3 Reliance on prof. management	0.931	0.781	1.000		3 Quality management schools	0.888	0.521	1.000			
4 Delegation of authority	0.943	0.803	0.951	1.000	4 Staff training on the job	0.846	0.830	0.547	1.000		
Pillar and indicators					Pillar and indicators						
	1	2	3	4	5		1	2	3	4	5
1 Creation of knowledge	1.000					1 Market conditions	1.000				
2 Collaboration in same sector	0.891	1.000				2 Market size	0.860	1.000			
3 Collaboration with customers	0.929	0.896	1.000			3 Foreign competition	0.799	0.365	1.000		
4 Univ/industry collaboration	0.827	0.616	0.671	1.000		4 Crossborder e-commerce	0.878	0.700	0.598	1.000	
5 International collaboration	0.883	0.769	0.814	0.522	1.000	5 Foreign direct investment	0.911	0.762	0.646	0.614	1.000
Pillar and indicators					Pillar and indicators						
	1	2	3	4	5	6		1	2	3	4
1 Access to finance	1.000						1 Tax and regulations	1.000			
2 Bank credit to private sector	0.667	1.000					2 Time on tax issues	0.841	1.000		
3 Ease of access to VC	0.796	0.295	1.000				3 Hiring & firing regulation	0.781	0.395	1.000	
4 Amount VC later stage	0.798	0.611	0.470	1.000			4 Burden of government regulation	0.918	0.743	0.590	1.000
5 Ease of access to equity funding	0.822	0.316	0.819	0.472	1.000						
6 Initial public offering	0.776	0.374	0.493	0.566	0.546	1.000					
Pillar and indicators					Pillar and indicators						
	1	2	3	4		1	2	3	4		
1 Infrastructure	1.000										
2 E-commerce	0.713	1.000									
3 Perc. of firms using ERC	0.646	0.253	1.000								
4 Broadband per population	0.889	0.538	0.410	1.000							
Correlations across pillars and index											
Index and pillars											
	1	2	3	4	5	6	7	8			
1 Scale-up Index	1.000										
2 Culture and institutions	0.914	1.000									
3 Access to human capital	0.861	0.826	1.000								
4 Creation of knowledge	0.418	0.285	0.148	1.000							
5 Market conditions	0.859	0.816	0.761	0.125	1.000						
6 Access to finance	0.854	0.779	0.786	0.068	0.738	1.000					
7 Tax and regulations	0.717	0.598	0.492	0.143	0.598	0.665	1.000				
8 Infrastructure	0.800	0.787	0.817	0.205	0.671	0.678	0.317	1.000			

Note: For reasons of readability several names of pillars and indicators have been abbreviated. Correlations between indicators and pillars or pillars and the entrepreneurship index are indicated in bold.

Calculations: EC JRC.

8.7 Impact of modelling assumptions

Every country score on the entrepreneurship and scale-up indices depends on subjective modelling choices: the selection of the indicators, the imputation or not of missing data, normalisation, the attribution of weights, and the aggregation method, among other elements. In this paragraph, a robust analysis is conducted to assess the simultaneous and joint impact of these modelling choices on the rankings. This analysis has been developed by the Competence Centre of Composite Indicators and Scoreboards of the

JRC Ispra (Saisana, Saltelli, & Tarantola, 2005). The data are assumed to be error-free, since potential outliers and eventual errors were corrected during the computation phase (see section 8.2).

The robustness assessment of ESIS is based on a combination of a Monte Carlo experiment and a multi-modelling approach that deals with three issues: pillar weights, missing data, and the aggregation method. This assessment aims at responding to the criticism that the country scores associated with aggregate measures are not calculated under conditions of certainty, even if they are often presented as such (Saisana, d'Hombres, & Saltelli, 2011).

Pillar weights

To test the influence of various weighting schemes on the indices performance, we conduct a Monte Carlo simulation including 1000 runs, each corresponding to a different set of weights of the seven pillars, randomly sampled from uniform continuous distributions centred in the reference values. The reference values refer to the weights used for the construction of ESIS. The choice of the range for the weights' variation is driven by the need of ensuring a wide enough interval to have meaningful robustness checks. Given this consideration, we define the following threshold values for the various indices:

Entrepreneurship index: as pillars have been aggregated into the index using equal weighting, the reference weight for each pillar elevates at 0.14 (i.e. 1/7). For the robustness analysis, each pillar will get assigned a random weight lying in the interval [0.11,0.17]. The sampled weights are then rescaled to unity sum.

Scale-up index: to partially compensate for the imbalance across pillars, the reference weights are allocated as follows: pillar on Culture and institutions: 0.07; pillar on Creation of knowledge and networking: 0.21 and equal weighting (i.e. 0.14) for the remaining pillars. For the robustness analysis, the aforementioned pillars will get a random weight lying in the respective intervals [0.06,0.08], [0.18,0.24] and [0.11,0.17]. The sampled weights are then rescaled to unity sum.

Missing data

In addition to variations in the weights, we assess the influence of using imputed data. The data used for constructing ESIS was not imputed for reasons of transparency and replicability. However, the choice of not imputing missing data might encourage countries not to report low data values. To overcome this limitation, we opted to test for the uncertainty of this modelling choice by imputing missing data using the Expectation Maximization (EM) algorithm.⁸ We expect that the imputation choice will have an impact on the country rankings of the entrepreneurship index, given the relatively high level of missing data in the pillar of Access to finance.⁹

⁸ The Expectation-Maximization (EM) algorithm (Little and Rubin, 2002) is an iterative procedure that finds the maximum likelihood estimates of the parameter vector by repeating two steps: (1) The expectation E-step: Given a set of parameter estimates, such as a mean vector and covariance matrix for a multivariate normal distribution, the E-step calculates the conditional expectation of the complete-data log likelihood given the observed data and the parameter estimates. (2) The maximization M-step: Given incomplete data log likelihood, the M-step finds the parameter estimates to maximize the complete-data log likelihood from the E-step. The two steps are iterated until the iterations converge.

⁹ We expect to obtain full country coverage for the alternative finance indicator in the near future. Hence, the update of the Entrepreneurship index will not suffer from this limitation.

Aggregation method

The pillars of ESIS have been aggregated using arithmetic means. As explained in section 8.4, this method can be criticised for the fact that it is a linear aggregation of data, exhibiting a constant compensability. In contrast to this method, geometric aggregation allows for less compensability in case of low values. This means that the geometric mean will be lower than the arithmetic mean if for instance a country reports high values on all its pillars except one. Hence, the geometric aggregation punishes for the bad performance in that dimension, and obliges the country to actively enhance on that particular dimension in order to improve its overall score. To explore the uncertainty of the indices due to geometric averages, we conduct analyses with this alternative aggregation method.

In total, four models were tested for each index based on the combination of no imputation versus EM imputation, arithmetic versus geometric average, combined with 1000 simulations per model (random weights versus fixed weights), for a total of 4000 simulations per index. Table 17 provides a summary of the uncertainties that are considered in ESIS.

Table 17: Sources of uncertainty in ESIS: weights, imputation, aggregation

I. Uncertainty in the imputation		
Reference	Alternative	
no imputation	imputation	
II. Uncertainty in the aggregation formula		
Reference	Alternative	
arithmetic average	geometric average	
III. Uncertainty in the weights		
Pillar	Reference value for the weight	Distribution assigned for the robustness analysis
Entrepreneurship index		
Culture and institutions	1/7	U[0.11,0.17]
Access to human capital	1/7	U[0.11,0.17]
Knowledge creation and networking	1/7	U[0.11,0.17]
Market conditions	1/7	U[0.11,0.17]
Access to finance	1/7	U[0.11,0.17]
Tax and regulations	1/7	U[0.11,0.17]
Infrastructure and supports	1/7	U[0.11,0.17]
Scale-up index		
Culture and institutions	1/14	U[0.06,0.08]
Access to human capital	1/7	U[0.11,0.17]
Knowledge creation and networking	1/4.66	U[0.18,0.24]
Market conditions	1/7	U[0.11,0.17]
Access to finance	1/7	U[0.11,0.17]
Tax and regulations	1/7	U[0.11,0.17]
Infrastructure and supports	1/7	U[0.11,0.17]

8.7.1 Uncertainty analysis results

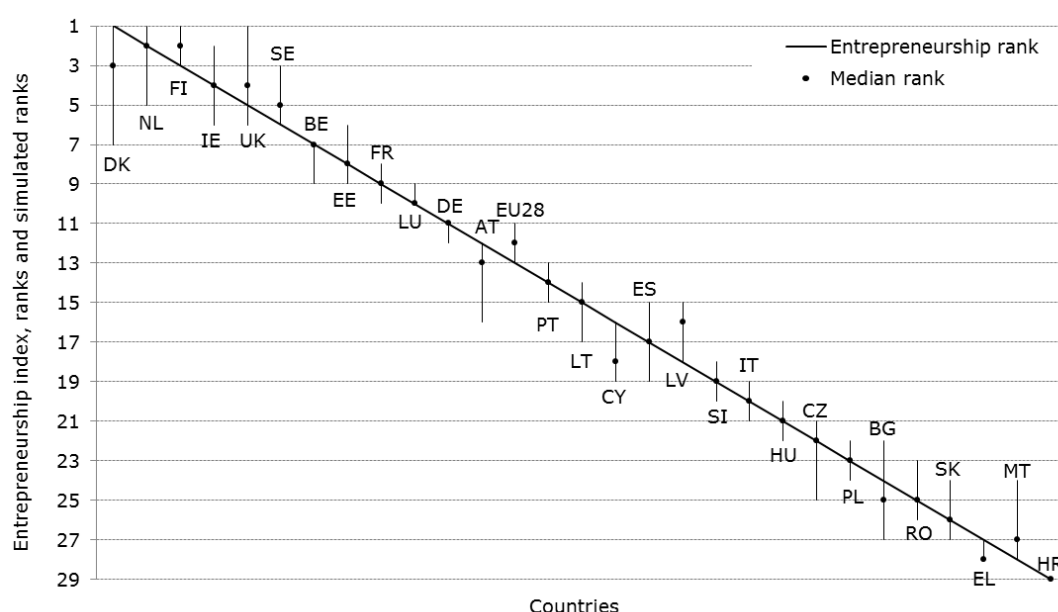
Figure 23 and Figure 24 present the results of the uncertainty analysis for the Entrepreneurship and Scale-up index. Countries are ordered from best to worst according to their reference rank (black line), the dot being the median rank. Error bars represent, for each country, the 90% interval across all simulations. All ESIS ranks lay within the simulated 90% confidence intervals.

For full transparency and information, Table 18 and Table 19 report ESIS country ranks together with the simulated median values and 90% confidence intervals in order to better appreciate the robustness of the results to the choice of weights, imputation and aggregation method. Confidence intervals wider than 3 positions are highlighted in red.

Entrepreneurship index

The ranking of the Entrepreneurship index is rather robust: the median rank is extremely close to the reference rank of the index as the absolute difference between both rankings is less than two positions for 90% of the countries. With regard to the 90% confidence interval widths, results show that almost 70% of the countries differ equal to 3 or less positions compared to the reference rank. Only three countries report intervals greater than 5 positions: Denmark, the United Kingdom and Bulgaria. In general the variation in country rankings is mainly driven by the choice of aggregation function (i.e. countries like Denmark with an imbalanced profile are penalised in case of geometric aggregation of pillars) and by the imputation choice. The uncertainty in weights seems to have less impact on the variation of country rankings (see section 8.7.2).

Figure 23: Robustness analysis (Entrepreneurship index rank vs. simulated ranks)



Note: The Spearman rank correlation between the median rank and the Entrepreneurship index rank is 0.995. Median ranks and intervals are calculated over 1,000 simulated scenarios combining random weights, imputation versus no imputation of missing values, and geometric versus arithmetic average at the pillar level. Calculations: EC JRC.

Table 18: Country ranks and 90% intervals for the Entrepreneurship index

Country	Rank	Median Rank	Interval	Country	Rank	Median Rank	Interval
DK	1	3	[1, 7]	CY	16	18	[16, 19]
NL	2	2	[1, 5]	ES	17	17	[15, 19]
FI	3	2	[1, 3]	LV	18	16	[15, 18]
IE	4	4	[2, 6]	SI	19	19	[18, 20]
UK	5	4	[1, 6]	IT	20	20	[19, 21]
SE	6	5	[3, 6]	HU	21	21	[20, 22]
BE	7	7	[7, 9]	CZ	22	22	[21, 25]
EE	8	8	[6, 9]	PL	23	23	[22, 24]
FR	9	9	[8, 10]	BG	24	25	[22, 27]
LU	10	10	[9, 10]	RO	25	25	[23, 26]
DE	11	11	[11, 12]	SK	26	26	[24, 27]
AT	12	13	[12, 16]	EL	27	28	[27, 28]
EU28	13	12	[11, 13]	MT	28	27	[24, 28]
PT	14	14	[13, 15]	HR	29	29	[29, 29]
LT	15	15	[14, 17]				

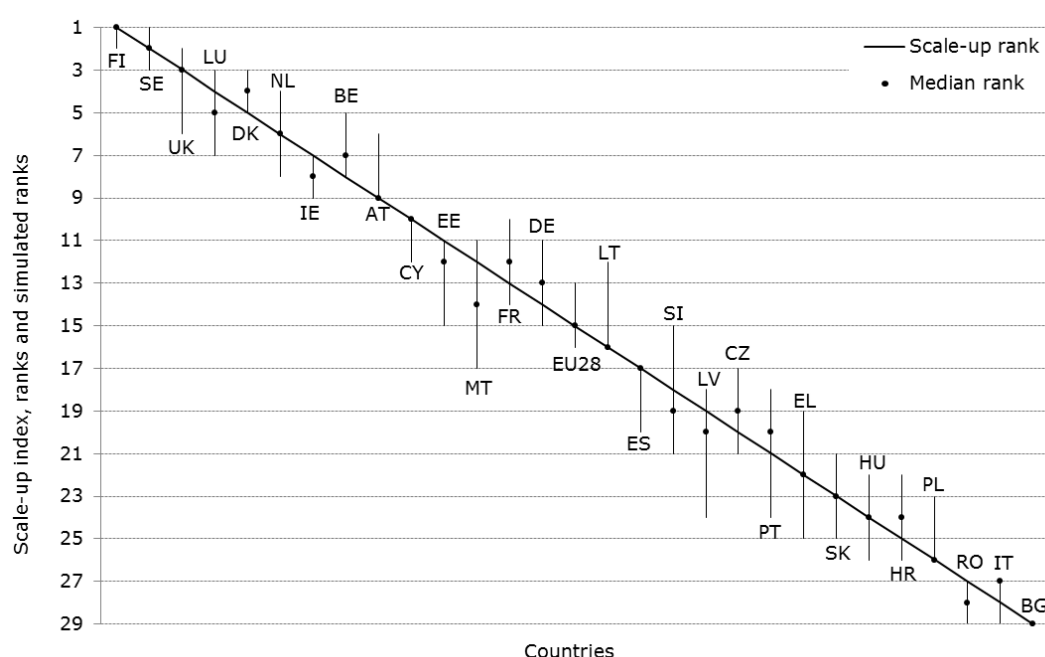
Note: Intervals are denoted in red when the interval range exceeds 3 positions.
Calculations: EC JRC.

Scale-up index

The median ranks resulting from the simulations are closely following the ranking of the Scale-up index: except for Malta, the difference between the two rankings is lower than 2 positions. The uncertainty results reveal that the two ends of the ranking distribution are relatively stable: the first ten countries and the four last countries in the ranking exhibit 90% confidence intervals lower or equal to 3 positions, with exception of the United Kingdom, Luxembourg and the Netherlands reporting interval widths of 4 positions. In contrast, the countries situated in the middle of the distribution are more volatile: most of them can shift up to 4 or 6 positions.

The higher volatility in the middle of the distribution is expected to be caused by the imbalance of the pillar on Creation of knowledge and networking with respect to the other pillars of the index. Low correlations of this pillar with its counterparts and a lower contribution of 18% to the index variance lead to a higher sensitivity related to shifts in weights. This sensitivity is attributable to the source of data that has been used to populate the pillar on Creation of knowledge and networking. So far, all indicators in the pillar are stemming from a unique data source being the Community innovation survey. Hence the pillar score may suffer from biases peculiar to this survey. The indicators collected are for instance based on the entire population of surveyed firms, making them potentially less representative for scale-up firms in certain countries. To improve the robustness of the next update of the Scale-up index, a revision of the indicators in this particular pillar is recommended and will be performed by refining the CIS indicators and by inclusion of indicators from alternative data sources.

Figure 24: Robustness analysis (Scale-up index rank vs. simulated ranks)



Note: The Spearman rank correlation between the median rank and the Scale-up index rank is 0.995. Median ranks and intervals are calculated over 1,000 simulated scenarios combining random weights, imputation versus no imputation of missing values, and geometric versus arithmetic average at the pillar level. Calculations: EC JRC.

Table 19: Country ranks and 90% intervals for the Scale-up index

Country	Rank	Median Rank	Interval	Country	Rank	Median Rank	Interval
FI	1	1	[1, 2]	LT	16	15	[12, 16]
SE	2	2	[1, 3]	ES	17	18	[17, 20]
UK	3	3	[2, 6]	SI	18	19	[15, 21]
LU	4	5	[3, 7]	LV	19	20	[18, 24]
DK	5	4	[3, 5]	CZ	20	19	[17, 21]
NL	6	6	[4, 8]	PT	21	20	[18, 24]
IE	7	8	[7, 9]	EL	22	22	[19, 25]
BE	8	7	[5, 8]	SK	23	23	[21, 25]
AT	9	8	[6, 9]	HU	24	24	[22, 26]
CY	10	11	[10, 12]	HR	25	24	[22, 26]
EE	11	12	[11, 15]	PL	26	25	[23, 26]
MT	12	14	[11, 17]	RO	27	28	[27, 29]
FR	13	12	[10, 14]	IT	28	28	[27, 29]
DE	14	13	[11, 15]	BG	29	29	[27, 29]
EU28	15	15	[13, 16]				

Note: Intervals are denoted in red when the interval range exceeds 3 positions. Calculations: EC JRC.

8.7.2 Sensitivity analysis results

Complementary to the uncertainty analysis, a sensitivity analysis has been conducted to investigate the relative importance of each modelling choice separately. As such, this analysis allows to identify which of the modelling assumptions have the greatest impact on the country rankings. Figure 25 and Figure 26 plot the ESIS indices versus one-at-a-time changes of either the imputation of missing data or the geometric aggregation formula, with adjustment of the weights. A deviation from the diagonal represents a shift

in ranking compared to the ESIS indices. By consequence, a closer distribution of countries along the diagonal indicates a lower sensitivity to the modelling choice.

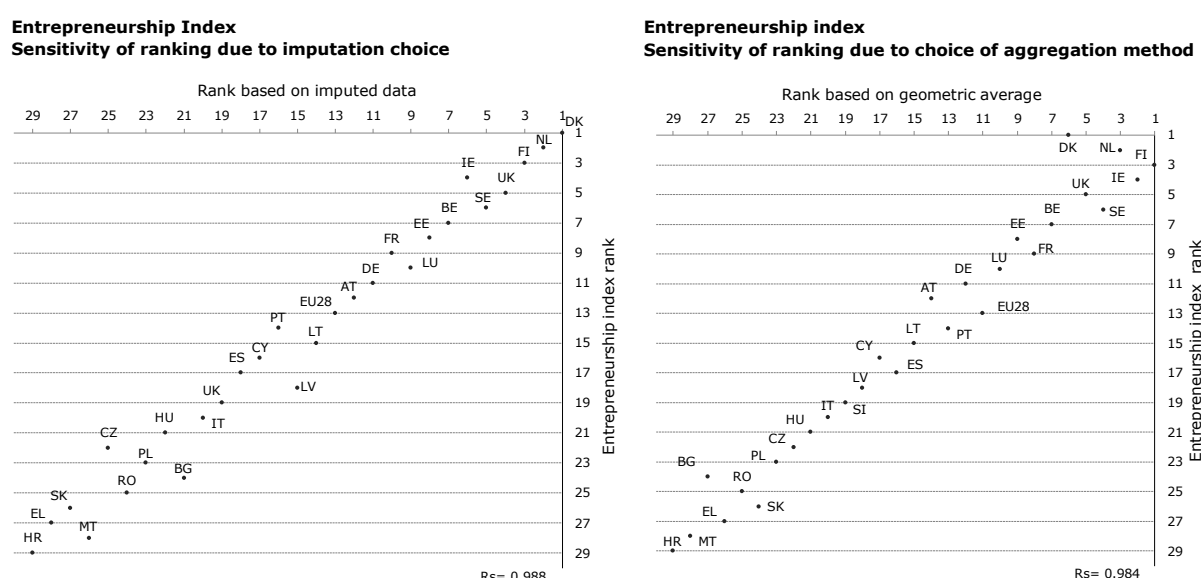
Entrepreneurship index

The patterns in Figure 25 reveal that the impact of imputation on the country rankings is more sensitive in the second half of the distribution, while the choice of the aggregation method is more influential in the second half. In general the impact remains relatively small. The percentage of countries shifting less than three positions is high in both cases, elevating at 90% and 93% for the sensitivity due to imputation and aggregation method respectively.

The most sensitive countries to the aggregation method are Bulgaria (shift of 3 positions) and Denmark (shift of 5 positions). The decision to implement a penalisation scheme for countries with unbalanced profiles by using geometric averages is an important consideration for the next update of the Entrepreneurship index as it has a considerable impact on the top ranked countries (Denmark declining 5 positions, while Finland and Ireland would gain positions).

Bulgaria, Latvia and the Czech Republic are the countries with the highest sensitivity to the imputation method, reporting shifts of 3 positions. The impact of the imputation method is expected to decrease even more once data on alternative finance will become available. Overall, the impact remains small and hence the decision not to impute missing data is justified from a statistical point of view.

Figure 25: Sensitivity analysis - impact of modelling choices on the Entrepreneurship index



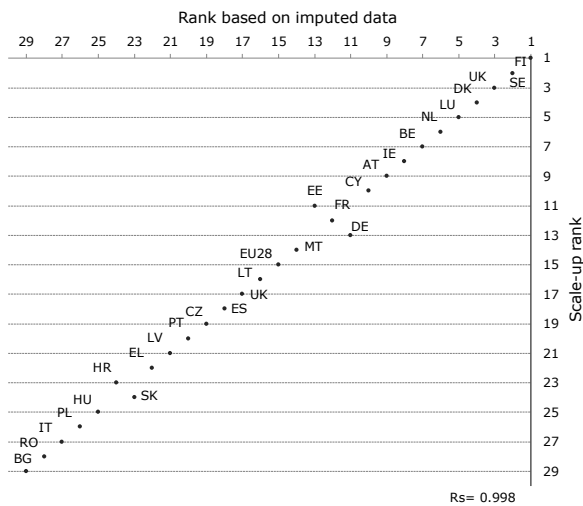
Scale-up index

Country rankings of the Scale-up index remain fairly robust due to the impact of imputation and aggregation methods. Country shifts remain below two positions for respectively 96% and 93% of the countries. Slovenia is the only country that reports larger sensitivities due to imputation and aggregation, but these shifts remain limited to respectively 3 and 4 positions. Once again, the loss of positions in case of geometric average is due to its unbalanced profile (i.e. relatively low scores on all but one pillars, while obtaining the best score on the pillar of Knowledge creation and networking).

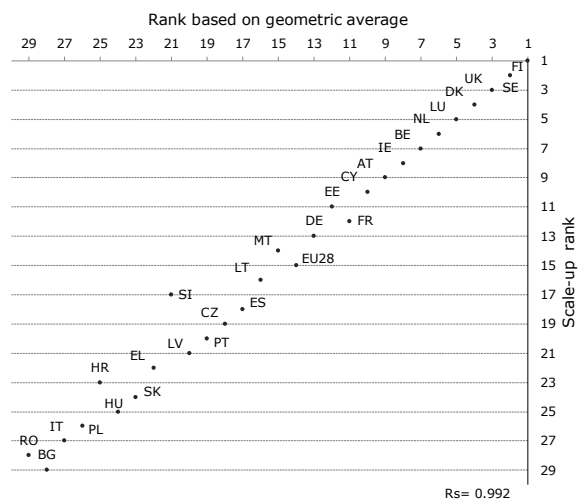
The stable pattern of the sensitivity analysis confirms the expectation in section 8.6 that the volatility in the rankings is mainly caused by the uncertainty in weights rather than by the imputation or aggregation choice. A revision of the pillar on Knowledge creation and networking is recommended for the next version of the Scale-up index in order to improve its stability.

Figure 26: Sensitivity analysis - impact of modelling choices on the Scale-up index

Scale-up Index
Sensitivity of ranking due to imputation choices



Scale-up index
Sensitivity of ranking due to choice of aggregation method



9 Lessons learned

This section summarises the key lessons learned from the pilot assessment of framework conditions for the creation and growth of firms in Europe.

Assessment of the framework conditions conducive to firm creation and growth

This report contributes to a better understanding of the framework conditions that lead to the emergence and the growth of entrepreneurial activities in the EU Member States. It takes into account a broad variety of framework conditions, including entrepreneurial culture, access to human capital, support initiatives for knowledge creation and networking, market conditions, availability of sufficient and appropriate finance, prevailing business regulations and the quality of supporting infrastructure. For each of these framework conditions, the report identifies the underlying components that affect the creation and growth of firms respectively. For this purpose, this report presents a set of two composite indicators – i.e. the Entrepreneurship and Scale-up Indices (ESIS) – which allows to compare EU Member States. As such, it serves as a working tool to monitor and benchmark EU Member States in creating a business-friendly environment that can foster both the creation and the growth of firms.

Robust measurement tool

The methodology to construct ESIS rigorously follows the "best practice" guidelines outlined in the OECD/JRC Handbook on constructing Composite Indicators (OECD and JRC 2008). The development of ESIS aims to be conceptually transparent and offers statistical justification at every methodological step. ESIS provides an analytically sound and robust measurement tool and makes recommendations for the further improvement of upcoming releases of the index. As ESIS is built with data from publicly-available sources, it can be updated annually and provides insights into performance changes over time.

Policy support mechanism

ESIS classifies EU Member States in different groups distinguishing between countries with excellent, very good, good, and fair framework conditions. This classification allows us to benchmark countries with their immediate peers (i.e. other countries within the same group). In addition, comparisons across two contiguous groups help to define reasonable targets for the improvement of framework conditions. For each group, ESIS identifies framework conditions that could be better supported by public governance in order to achieve the levels of the next group. As such, ESIS calls for realistic policy actions and does not suggest that all Member States should target the long-term achievements of the top-ranked countries. In this respect, ESIS serves as a supportive tool to help outline and define the future challenges of entrepreneurship policies in Europe and the EU Member States.

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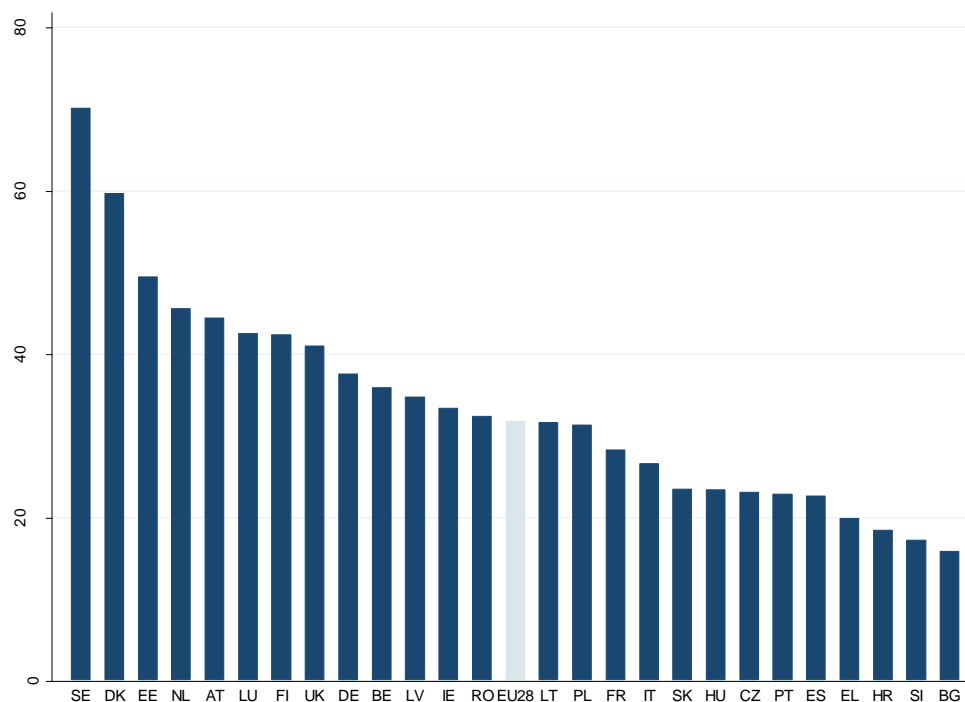
Appendix

Indicators on Culture and institutions

The country rankings for the indicators on Culture and institutions for the Entrepreneurship and Scale-up index are presented below.

Entrepreneurship index

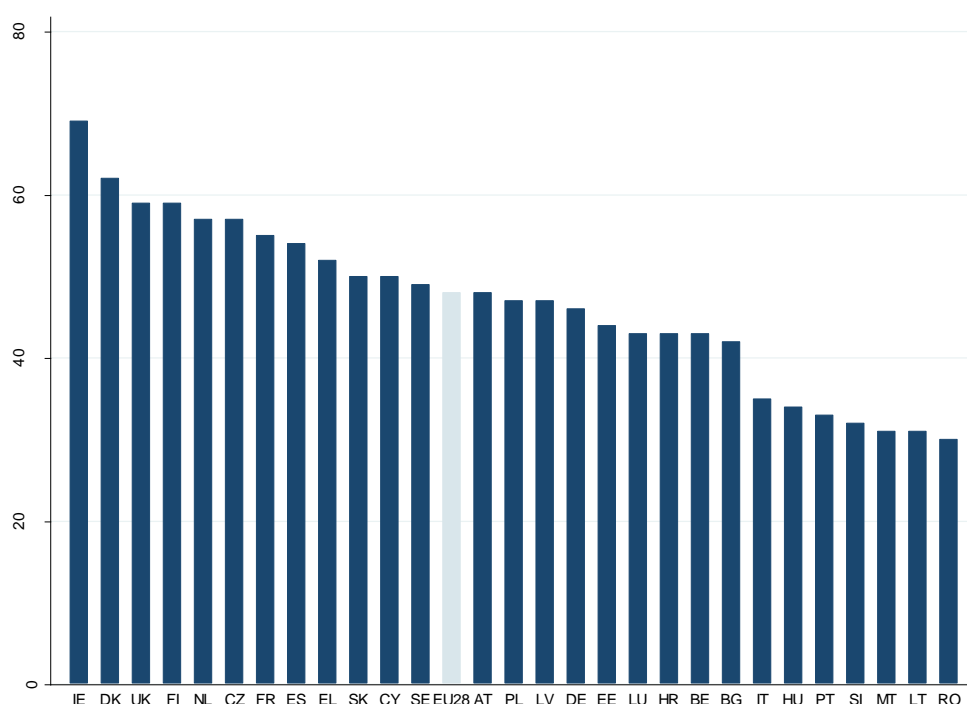
Figure 27: Culture and institutions – Opportunity recognition



Note: The graph represents the weighted percentage of 18-64 population who see good opportunities to start a firm in the area where they live. The reference year is 2014 except for following countries for which data was not available: Bulgaria (2015), Czech Republic (2013) and Latvia (average of 2013 and 2015). The EU28 indicator is calculated as a population weighted average of EU28 countries.

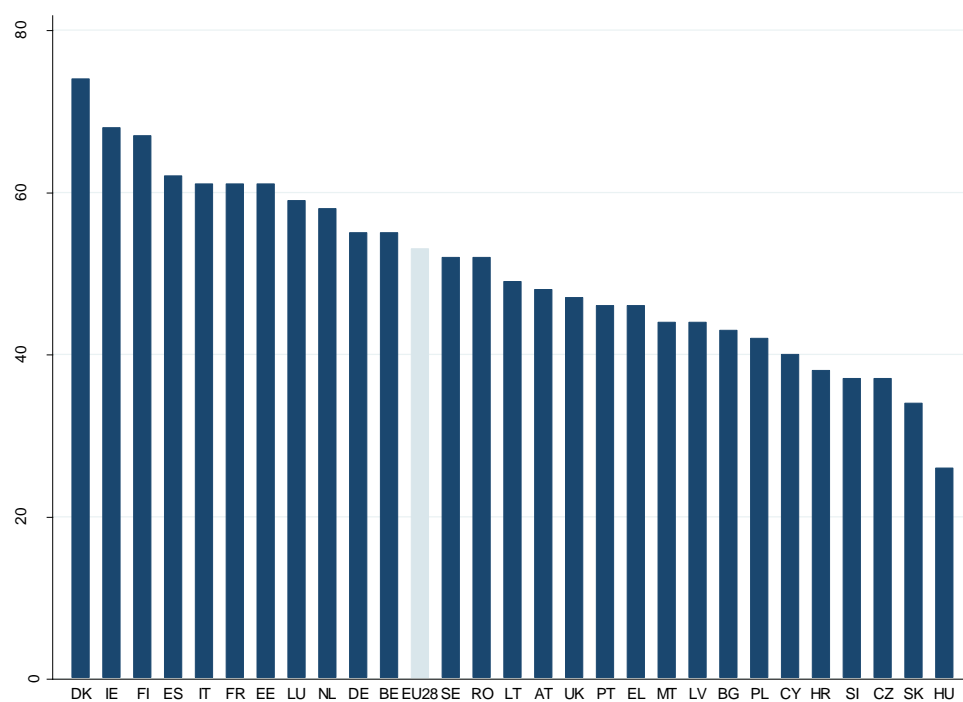
Data source: Global Entrepreneurship Monitor.

Figure 28: Culture and institutions – Risk acceptance



Note: The graph represents the weighted percentages of survey respondents who disagreed with the statement: "One should not start a business if there is a risk it might fail". The survey was conducted in 2012.
Data source: Flash Eurobarometer 354.

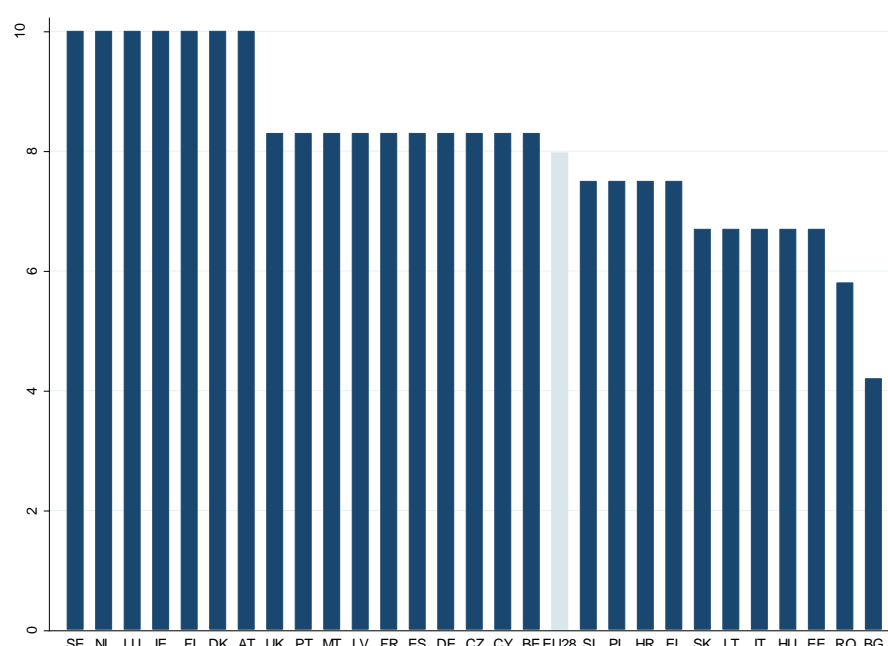
Figure 29: Culture and institutions – Image of entrepreneurs



Note: The graph represents the weighted percentage of survey respondents who were broadly favourable on the statement: "What is your overall opinion about the following groups of people: Entrepreneurs (self-employed, business owners)?". The survey was conducted in 2012.
Data source: Flash Eurobarometer 354.

Scale-up index

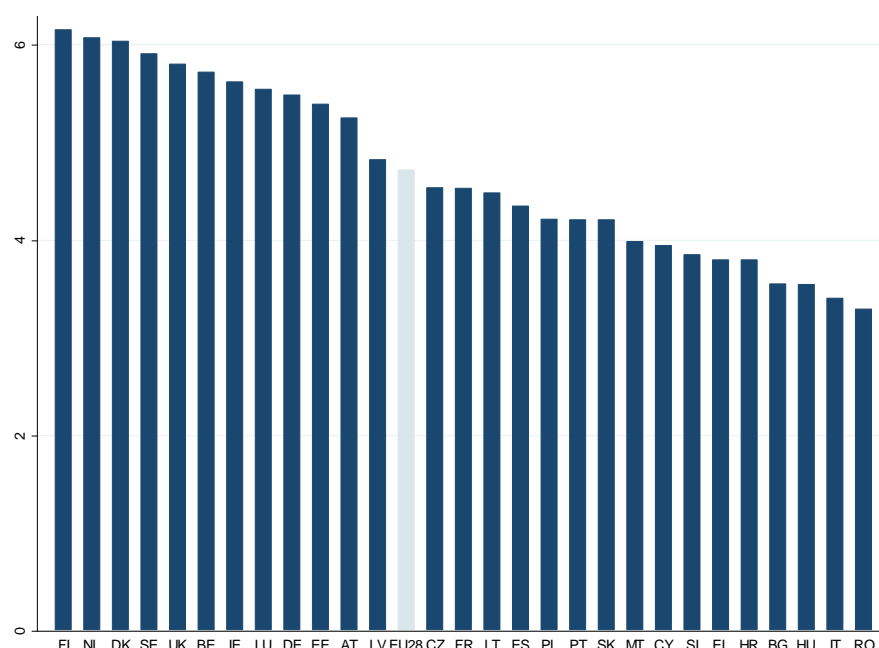
Figure 30: Culture and institutions – Integrity of the legal system



Note: The graph represents the integrity of a country's legal system in 2013 based on 1) the strength and impartiality of the legal system and 2) the assessment of the observance of the law. The EU28 indicator is calculated as a population weighted average of EU28 countries.

Data source: Economic Freedom of the World.

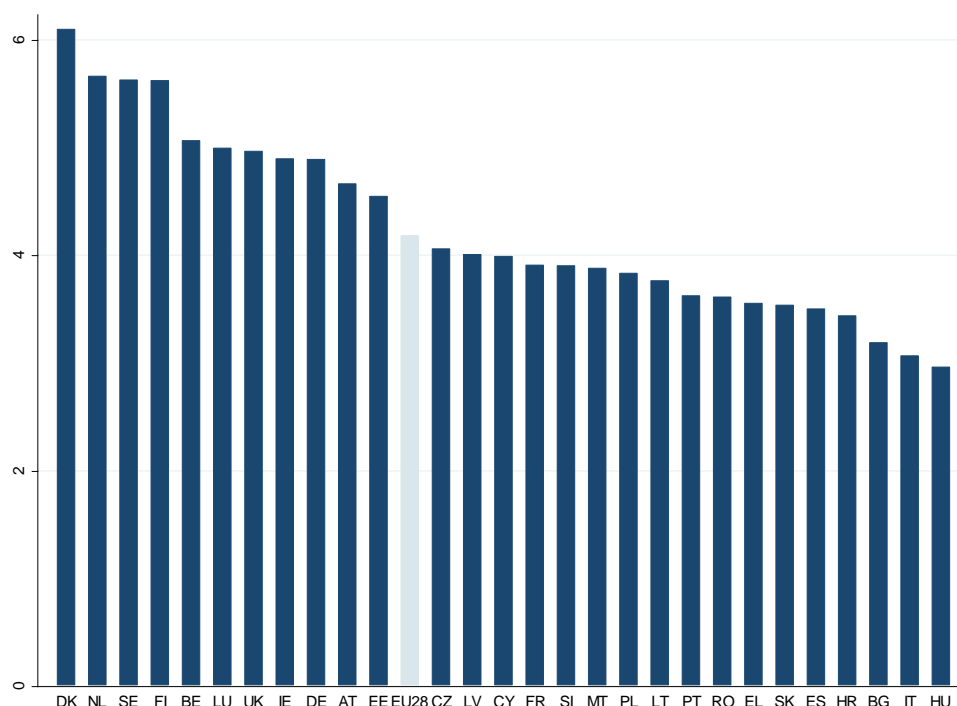
Figure 31: Creation of knowledge and networking – Reliance on professional management



Note: The graph represents the 2013-2014 weighted average of survey responses on the question: "In your country, who holds senior management positions? [1 = usually relatives or friends without regard to merit; 7 = mostly professional managers chosen for merit and qualifications]". The EU28 indicator is calculated as a population weighted average of EU28 countries.

Data source: World economic forum (WEF).

Figure 32: Creation of knowledge and networking – Willingness to delegate authority



Note: The graph represents the 2013-2014 weighted average of survey responses on the question: "In your country, how do you assess the willingness to delegate authority to subordinates? [1 = not willing at all—senior management takes all important decisions; 7 = very willing—authority is mostly delegated to business unit heads and other lower-level managers]". The EU28 indicator is calculated as a population weighted average of EU28 countries.

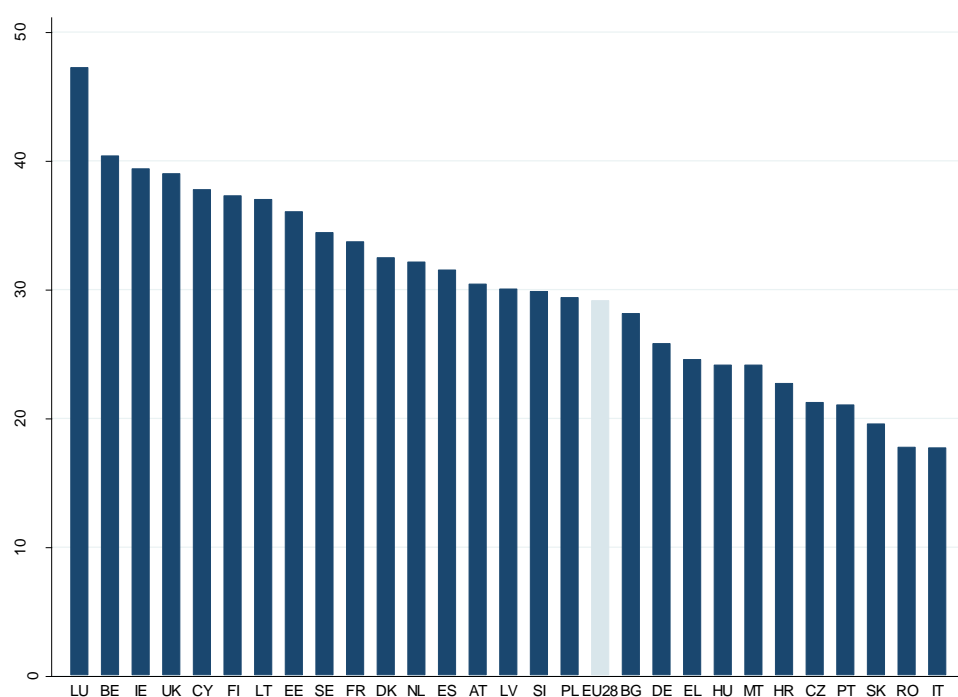
Data source: World economic forum (WEF).

Indicators on Access to human capital

The country rankings for the indicators on Access to human capital for the Entrepreneurship and Scale-up index are presented below.

Entrepreneurship index

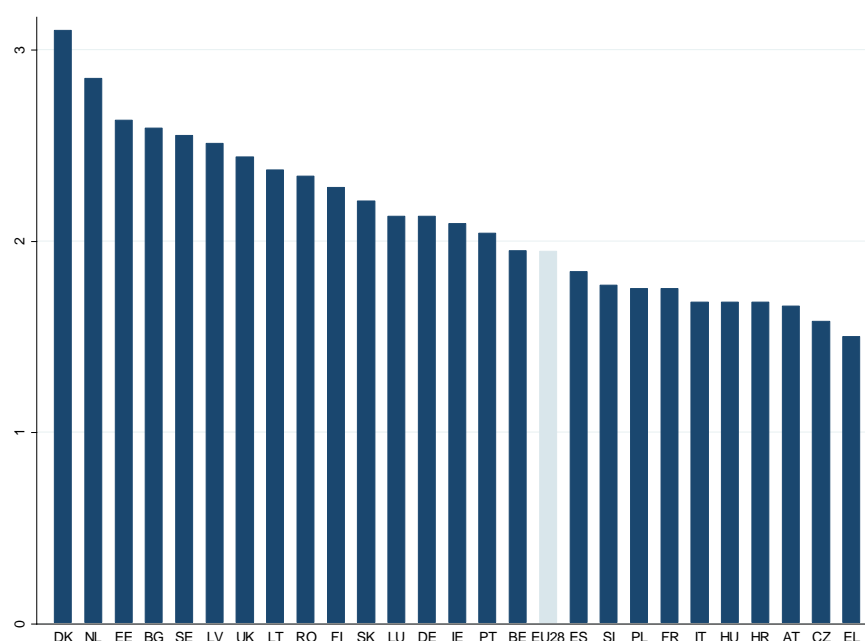
Figure 33: Access to human capital – Tertiary education



Note: The graph represents the gross enrolment in tertiary education (levels 5-8) as share of the active population in 2014.

Data source: Eurostat.

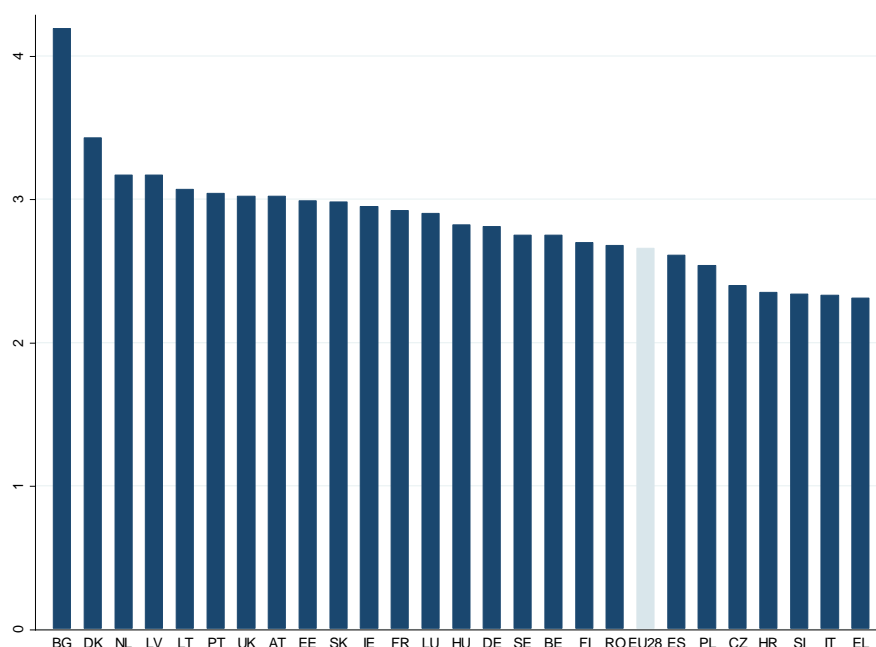
Figure 34: Access to human capital – Entrepreneurship schooling during lower education



Note: The graph represents the extent to which training in creating or managing SMEs is incorporated within the education and training system at primary and secondary levels. The reference year is 2014 except for following countries for which data was not available: Bulgaria (2015), Czech Republic (2013) and Latvia (average of 2013 and 2015). The EU28 indicator is calculated as a population weighted average of EU28 countries.

Data source: Global Entrepreneurship Monitor.

Figure 35: Access to human capital – Entrepreneurship schooling during higher education

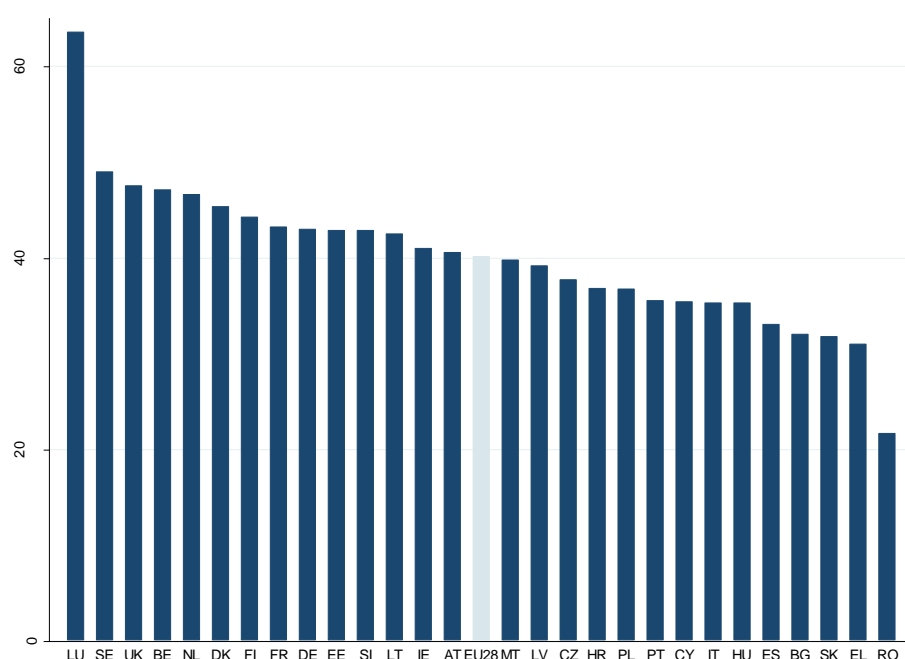


Note: The graph represents the extent to which training in creating or managing SMEs is incorporated within the education and training system in higher education such as vocational, college, business schools. The reference year is 2014 except for following countries for which data was not available: Bulgaria (2015), Czech Republic (2013) and Latvia (average of 2013 and 2015). The EU28 indicator is calculated as a population weighted average of EU28 countries.

Data source: Global Entrepreneurship Monitor.

Scale-up index

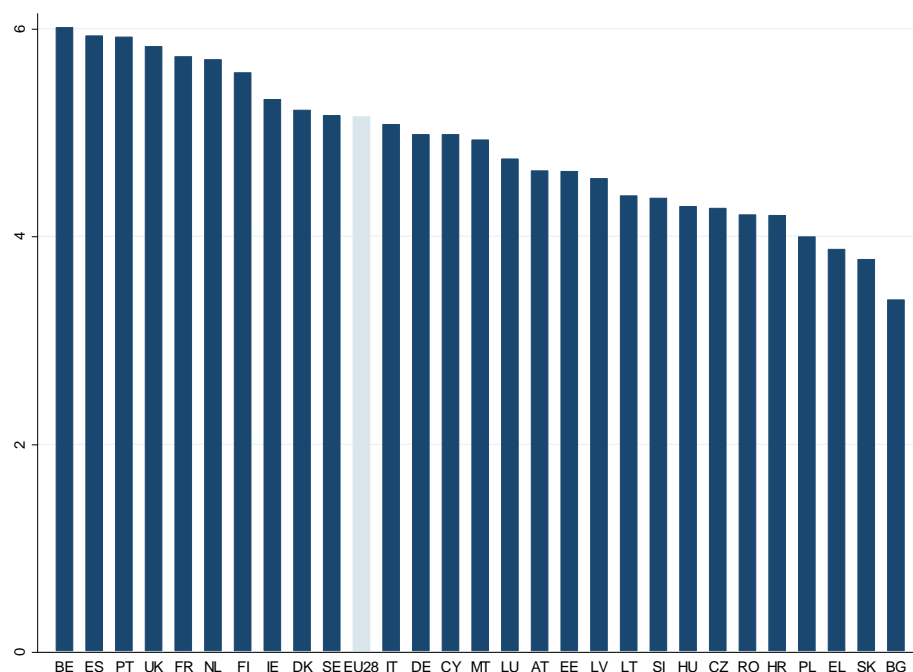
Figure 36: Access to human capital – Availability of managerial and technical capabilities on the labour market



Note: The graph represents the percentage of the active population in managerial and technical occupations in 2014.

Data source: Eurostat/ILO.

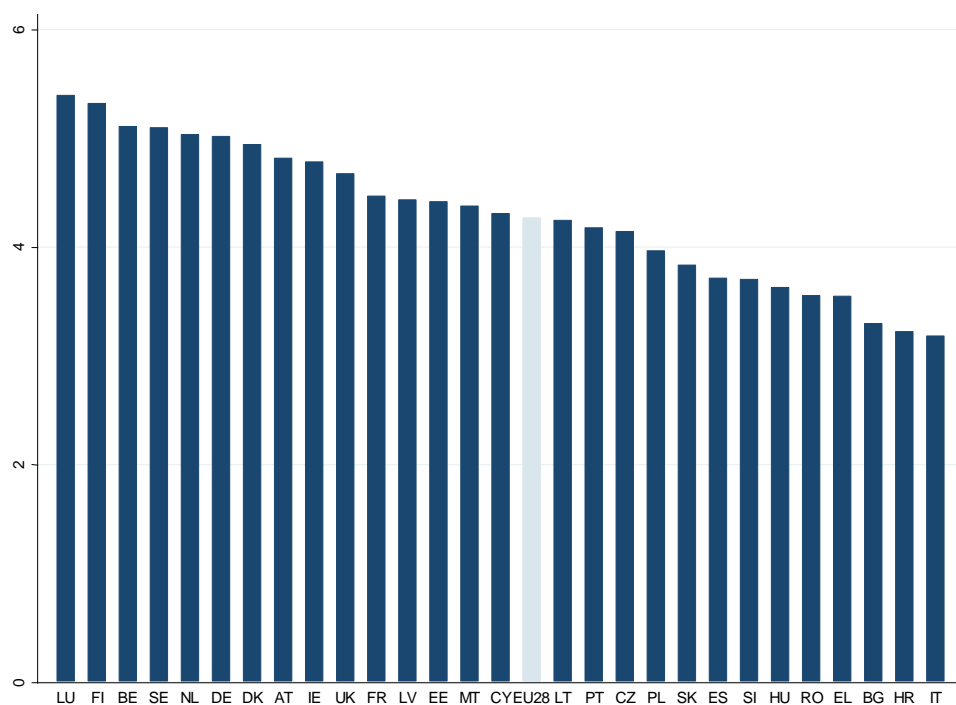
Figure 37: Access to human capital – Quality of management schools



Note: The graph represents the 2013-2014 weighted average of survey responses on the question: "The quality of management schools across countries is (limited or of poor quality for 1, to amongst the best in the world for 7)". The EU28 indicator is calculated as a population weighted average of EU28 countries.

Data source: World economic forum (WEF).

Figure 38: Access to human capital – Staff training



Note: The graph represents the 2013-2014 weighted average of survey responses on the question: "To what extent do companies in your country invest in training and employee development? (1 = hardly at all; 7 = to a great extent)". The EU28 indicator is calculated as a population weighted average of EU28 countries.

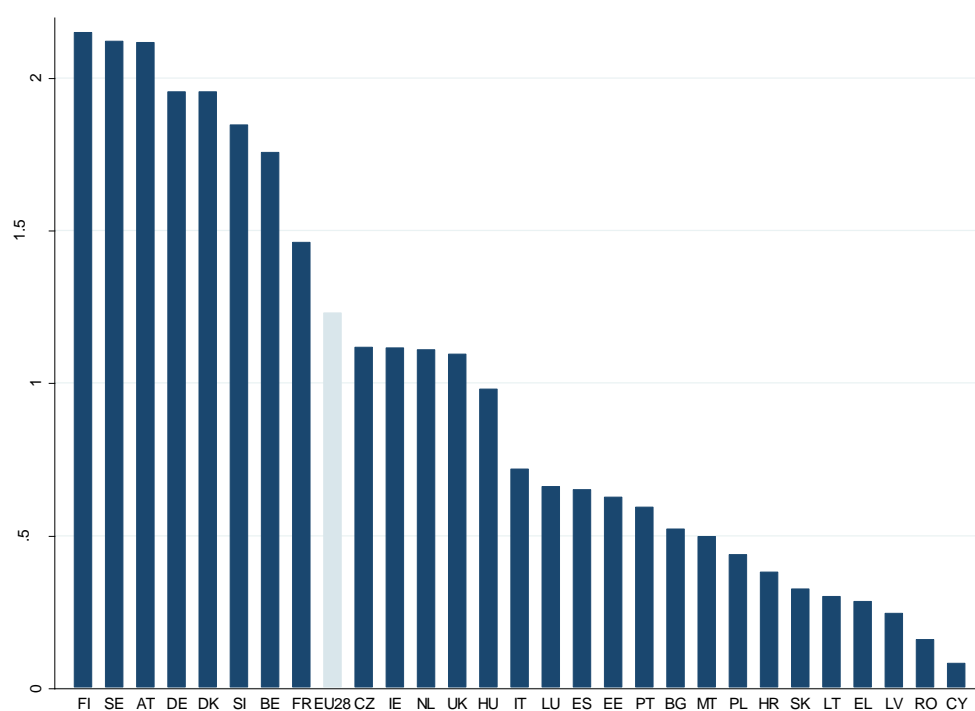
Data source: World economic forum (WEF).

Indicators on Creation of knowledge and networking

The country rankings for the indicators on Creation of knowledge and networking for the Entrepreneurship and Scale-up index are presented below.

Entrepreneurship index

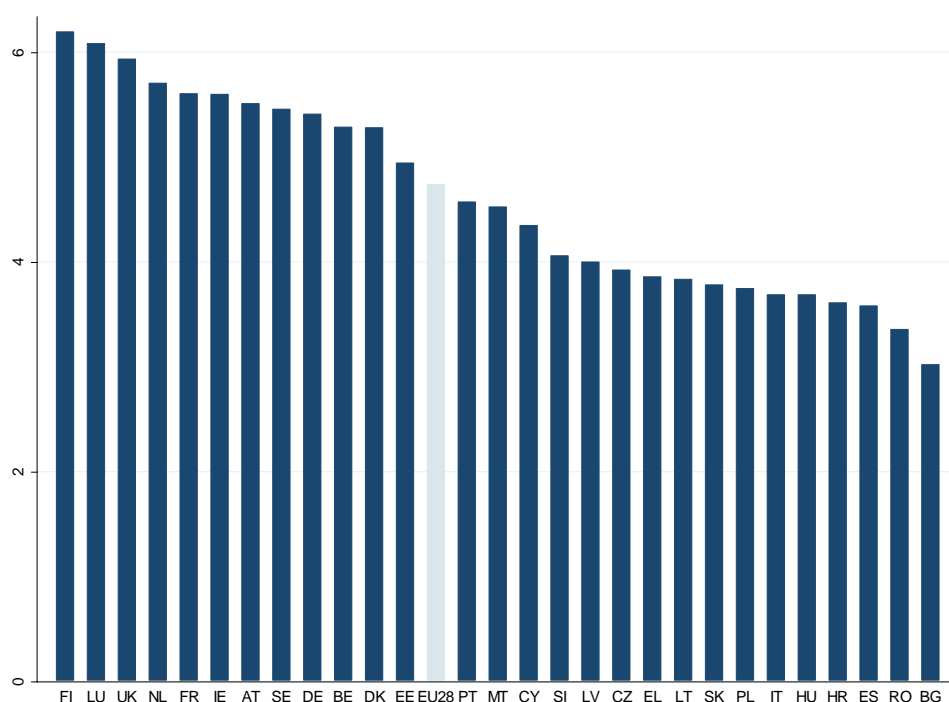
Figure 39: Creation of knowledge and networking – Business R&D expenditure



Note: The graph represents the amount business expenditure on R&D (BERD) as a percentage of GDP (in PPP) in 2014.

Data source: Eurostat.

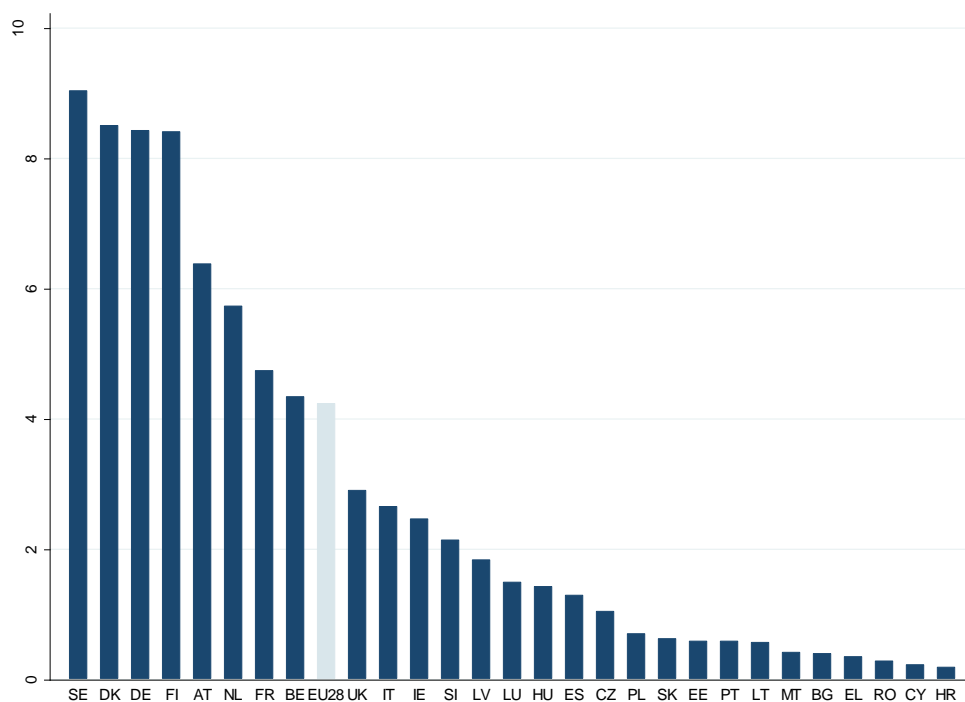
Figure 40: Creation of knowledge and networking – Intellectual property right



Note: The graph represents the 2013-2014 weighted average of survey responses on the intellectual property protection in the world (1 = is weak or nonexistent, 7 = is equal to the world's most stringent). The EU28 indicator is calculated as a population weighted average of EU28 countries.

Data source: World economic forum (WEF).

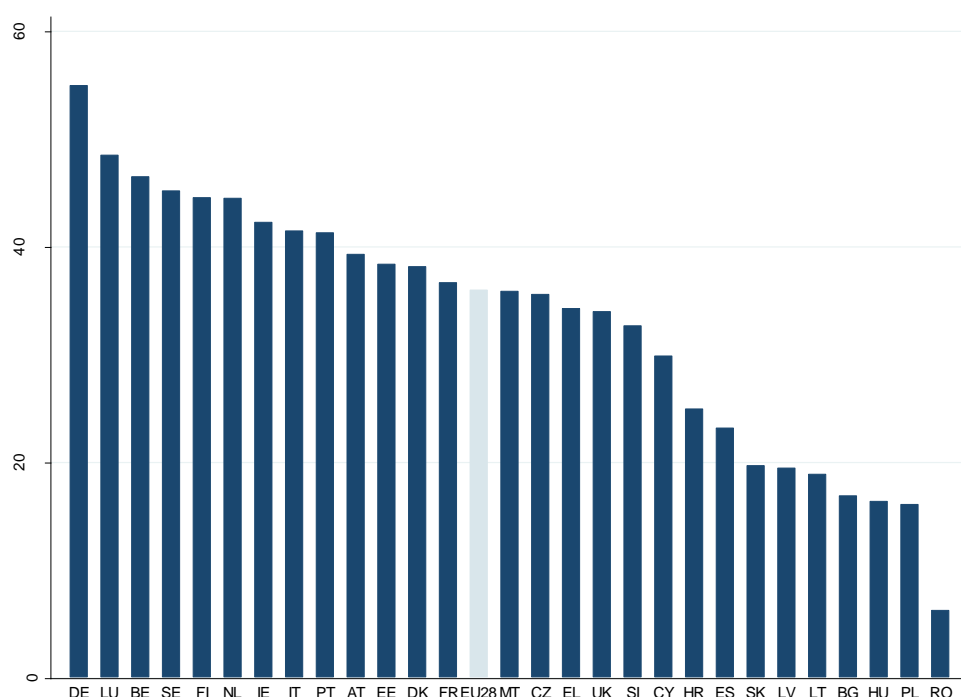
Figure 41: Creation of knowledge and networking – Patents



Note: The graph represents the number of patents per thousand GDP (in PPP) in 2014.

Data source: Eurostat.

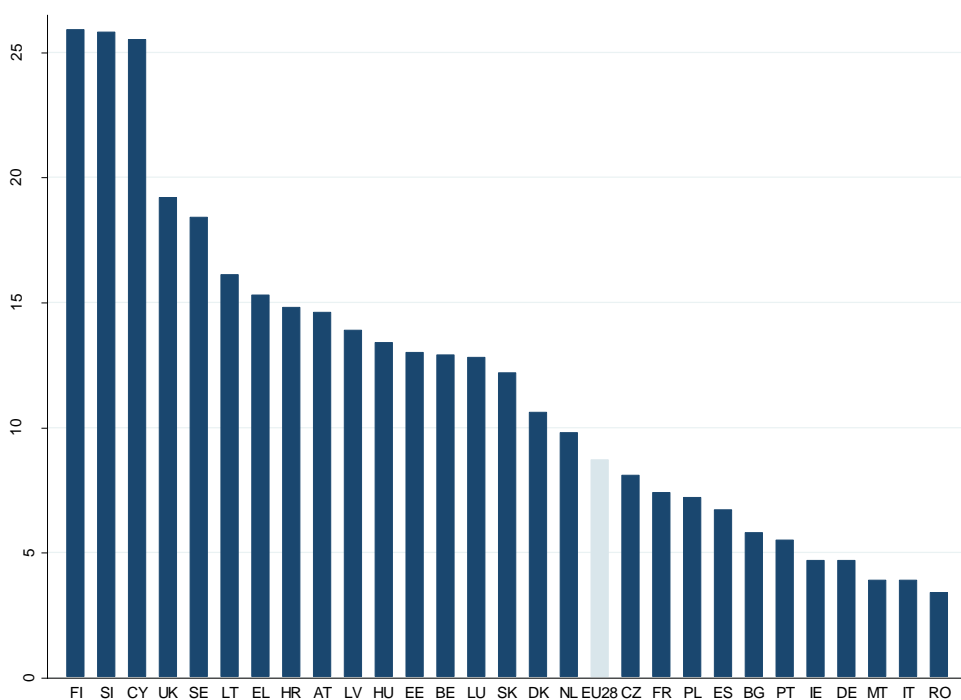
Figure 42: Creation of knowledge and networking – Product and process innovations



Note: The graph represents the share of firms with product and/or process innovations in 2012.
Data source: Eurostat – Community innovation survey.

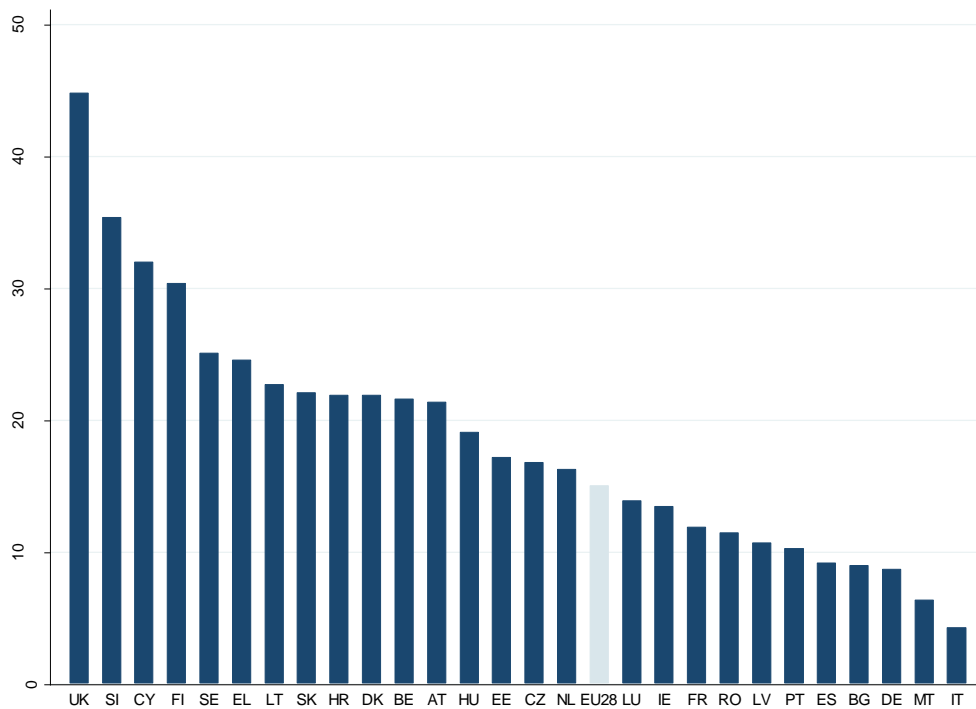
Scale-up index

Figure 43: Access to human capital – Collaboration with other firms



Note: The graph represents the percentage of innovative enterprises collaborating with competitors or other enterprises of the same sector in 2012.
Data source: Eurostat – Community innovation survey.

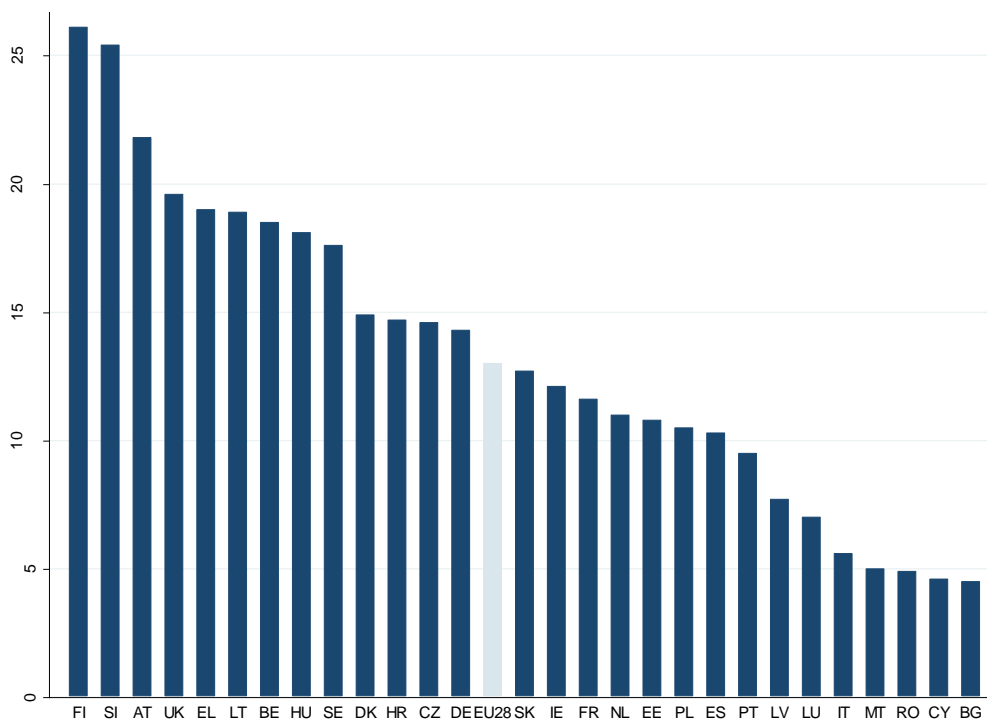
Figure 44: Access to human capital – Collaboration with customers



Note: The graph represents the percentage of innovative enterprises collaborating with clients or customers from the private sector in 2012.

Data source: Eurostat – Community innovation survey.

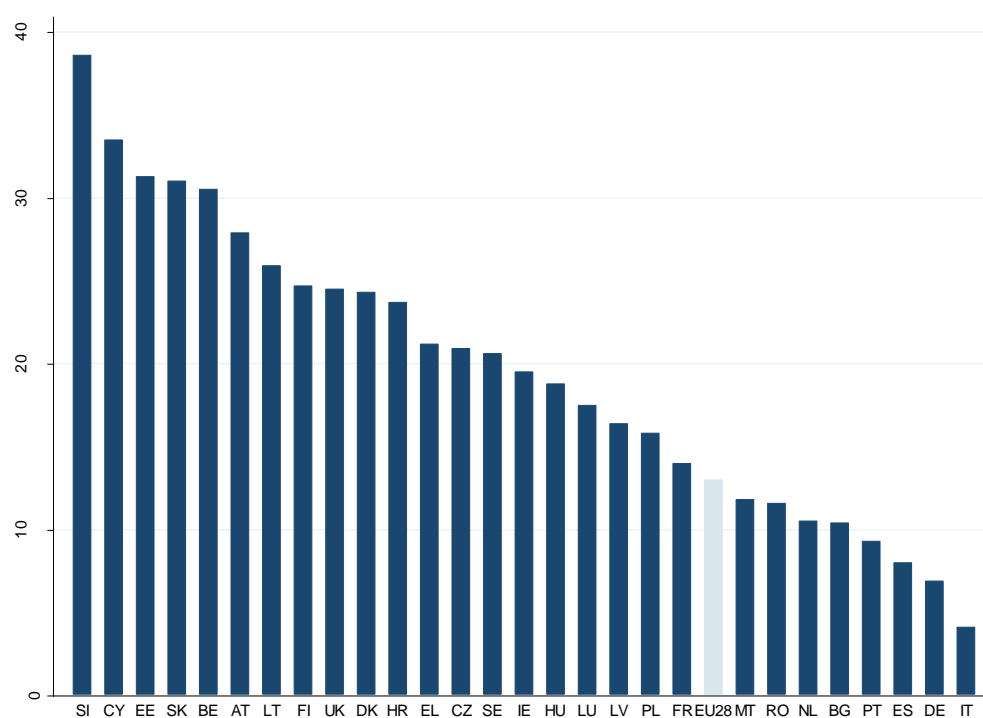
Figure 45: Access to human capital – University-industry collaboration



Note: The graph represents the percentage of innovative enterprises collaborating with universities or other higher education institutions in 2012.

Data source: Eurostat – Community innovation survey.

Figure 46: Access to human capital – International collaboration



Note: The graph represents the percentage of enterprises engaged in any type of innovation collaboration with a partner in EU countries, EFTA or EU candidates countries (except a national partner) in 2012.

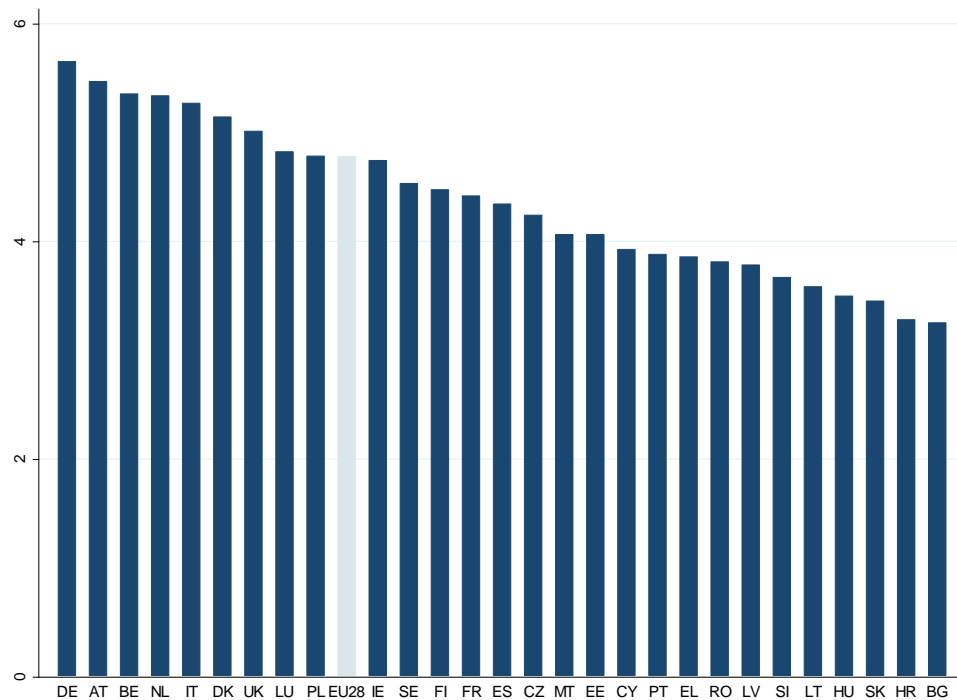
Data source: Eurostat – Community innovation survey.

Indicators on Market conditions

The country rankings for the indicators on Market conditions for the Entrepreneurship and Scale-up index are presented below.

Entrepreneurship index

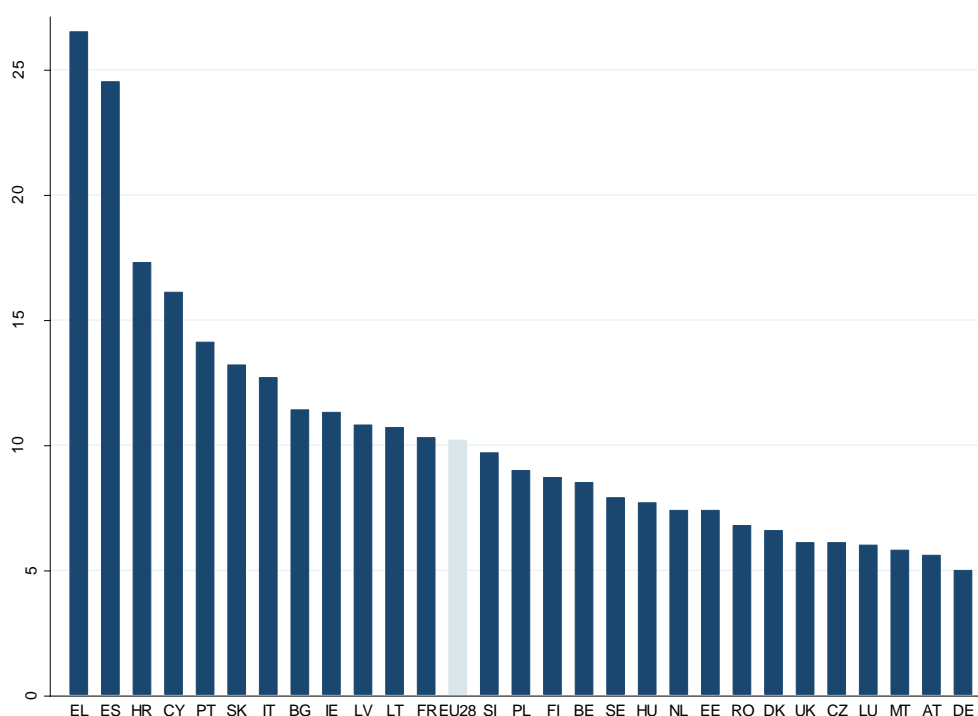
Figure 47: Market conditions – Market dominance



Note: The graph represents the 2013-2014 weighted average of survey responses on "Corporate activity in your country is (1 = dominated by a few business groups, 7 = spread among many firms)". The EU28 indicator is calculated as a population weighted average of EU28 countries.

Data source: World economic forum (WEF).

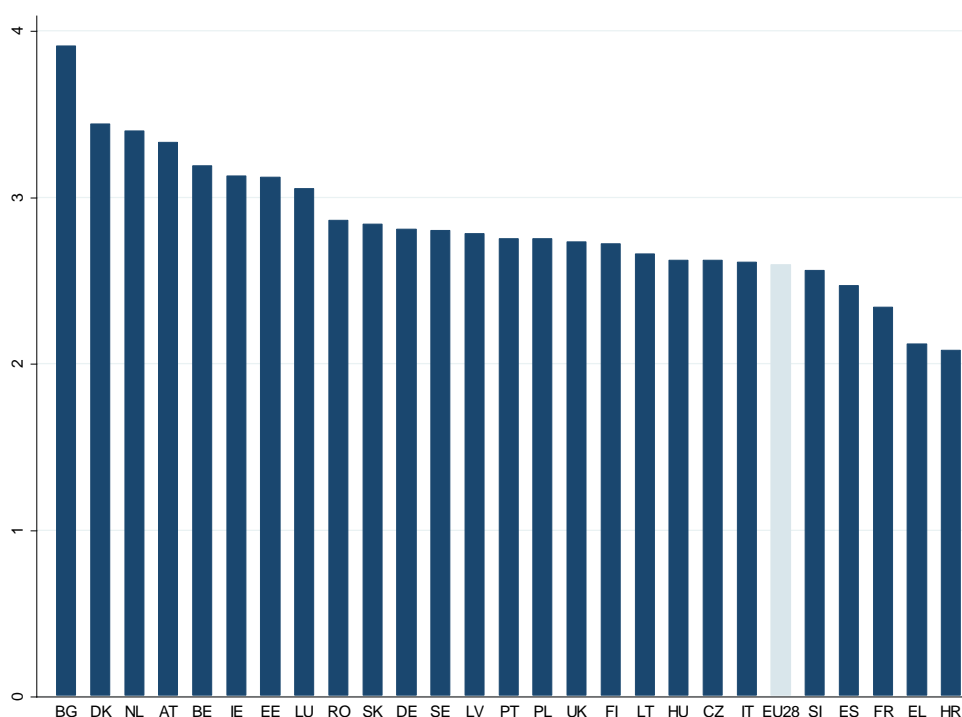
Figure 48: Market conditions – Unemployment rate



Note: The graph represents the unemployment rate in 2014. Hence, in contrast to the other graphs in this report, the best performing countries are situated at the right.

Data source: Eurostat.

Figure 49: Market conditions – Internal market openness

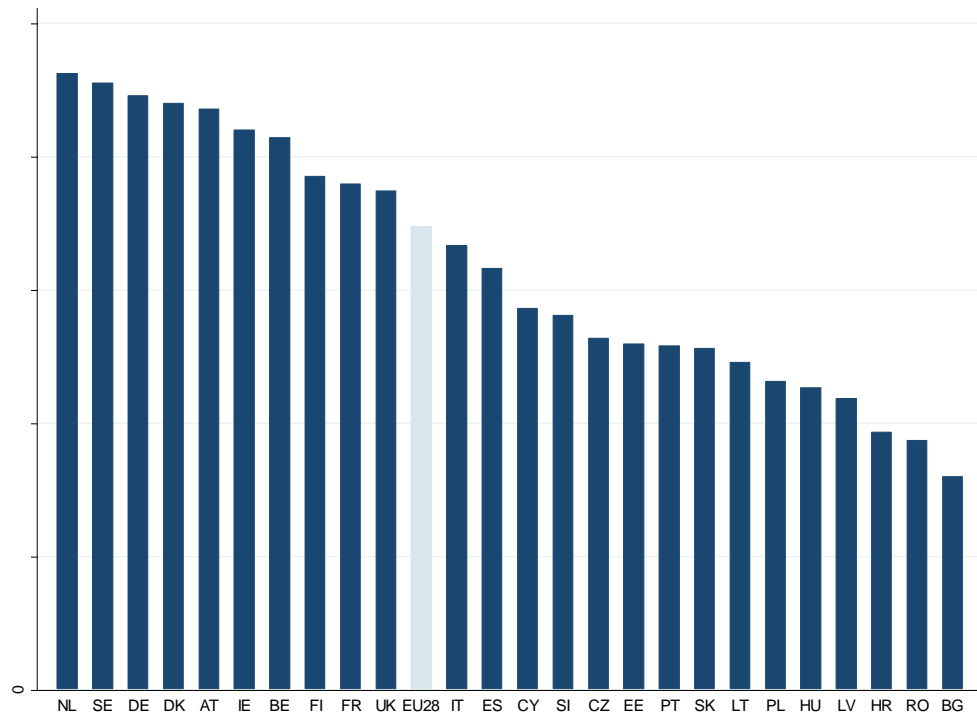


Note: The graph represents the extent to which new firms are free to enter existing markets in 2014. The EU28 indicator is calculated as a population weighted average of EU28 countries.

Data source: Global entrepreneurship monitor.

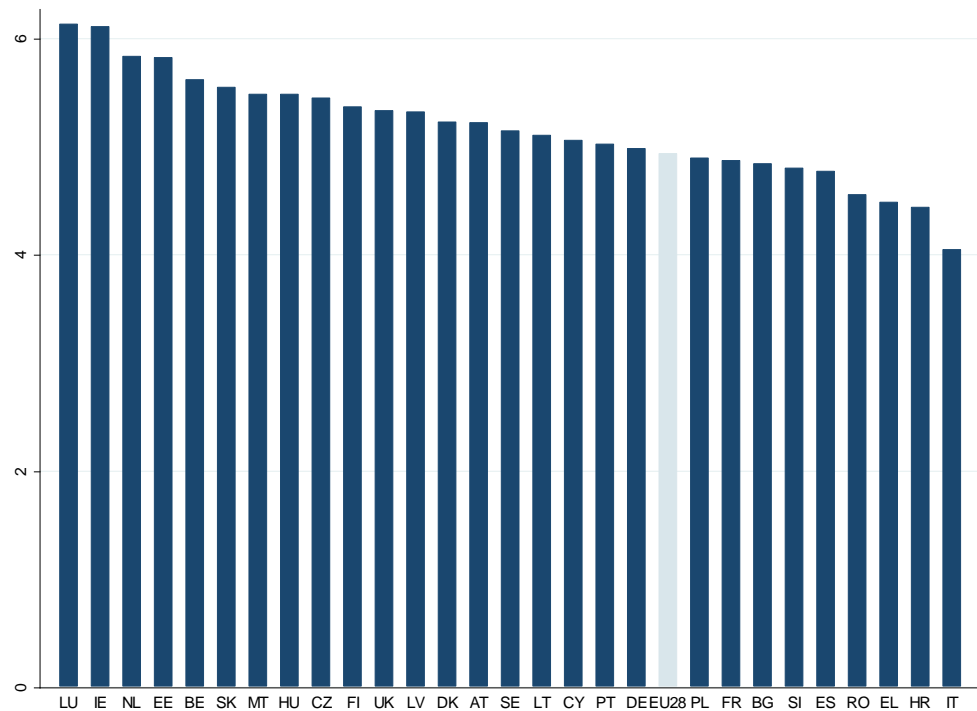
Scale-up index

Figure 50: Market conditions – Market size



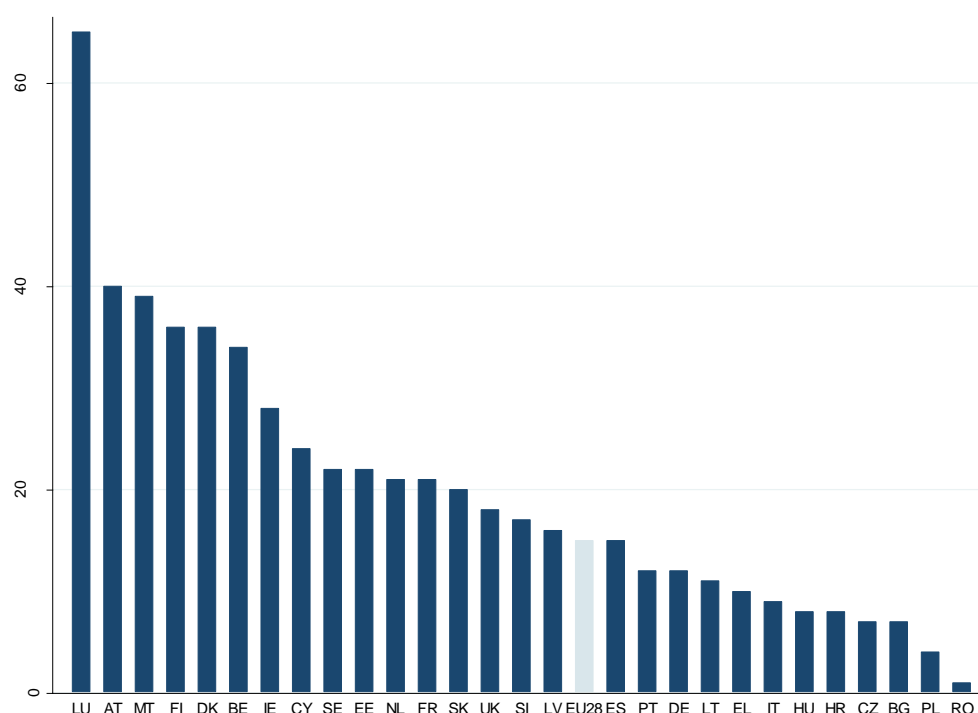
Note: The graph represents the GNI (in PPP) per capita in 2014.
Data source: World Bank.

Figure 51: Market conditions – Foreign competition



Note: The graph represents the foreign competition pillar of the Global Competitiveness index in 2014.
Data source: World economic forum (WEF).

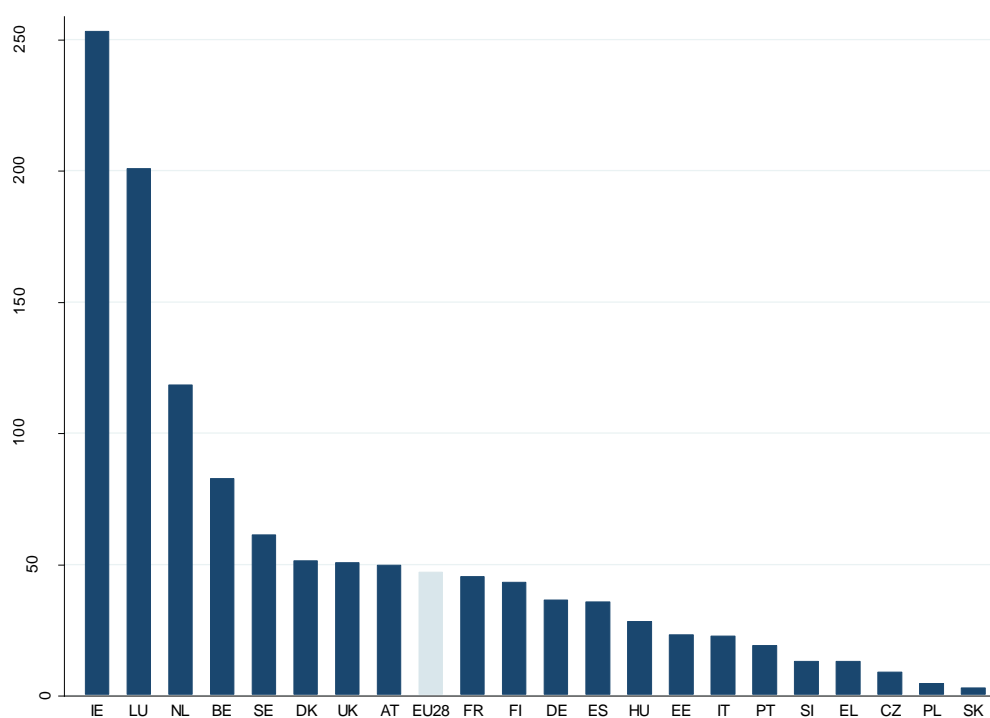
Figure 52: Market conditions – Cross-border e-commerce



Note: The graph represents the percentage of individuals buying goods or services over the internet from sellers from other EU countries in the last 12 months in 2014.

Data source: Eurostat.

Figure 53: Market conditions – Foreign direct investment



Note: The graph represents the outward foreign direct investment stock as percentage of GDP in 2014.

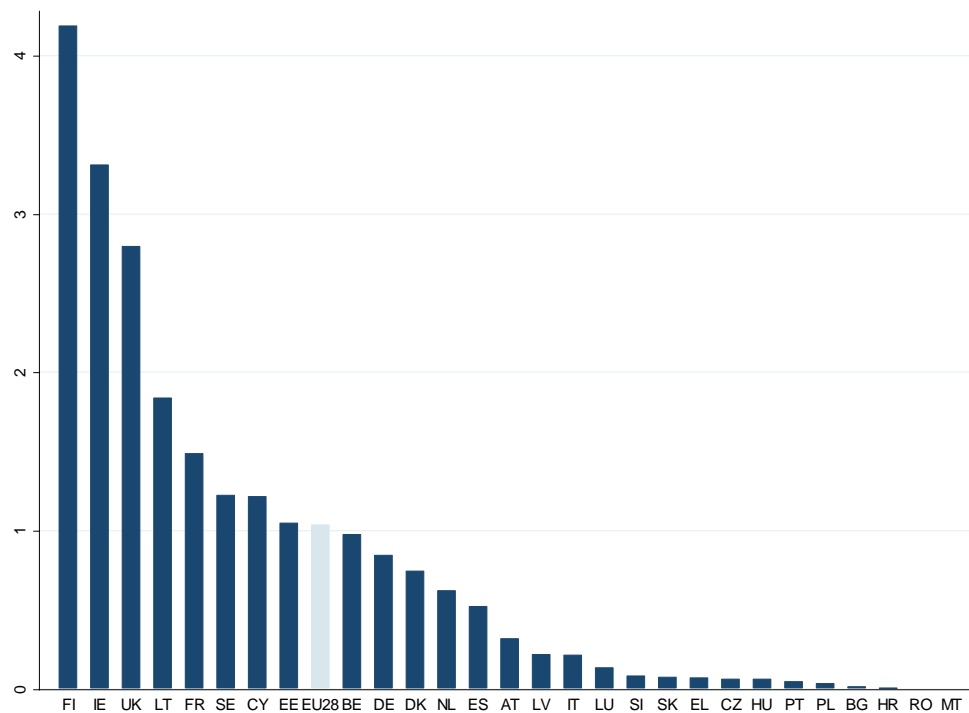
Data source: OECD.

Indicators on Access to finance

The country rankings for the indicators on Access to finance for the Entrepreneurship and Scale-up index are presented below.

Entrepreneurship index

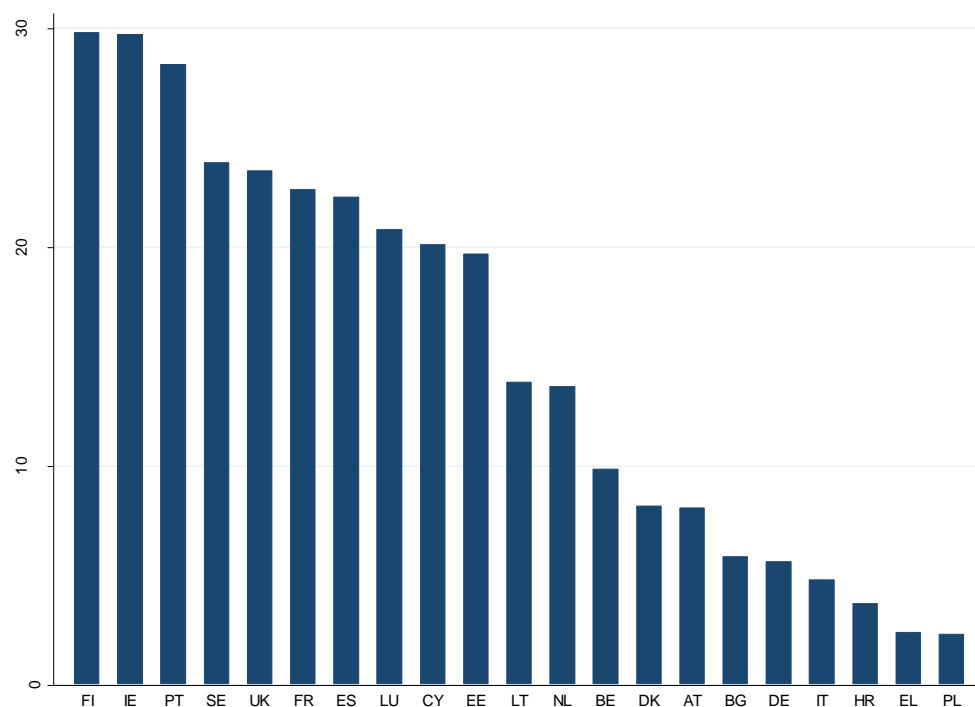
Figure 54: Access to finance – Seed and first-stage VC funding



Note: The graph represents the amount of seed and first stage VC funding (calculated as 3-year moving averages) per GDP (in ten thousands euro, PPP) in 2014.

Data source: VentureSource by Dow-Jones.

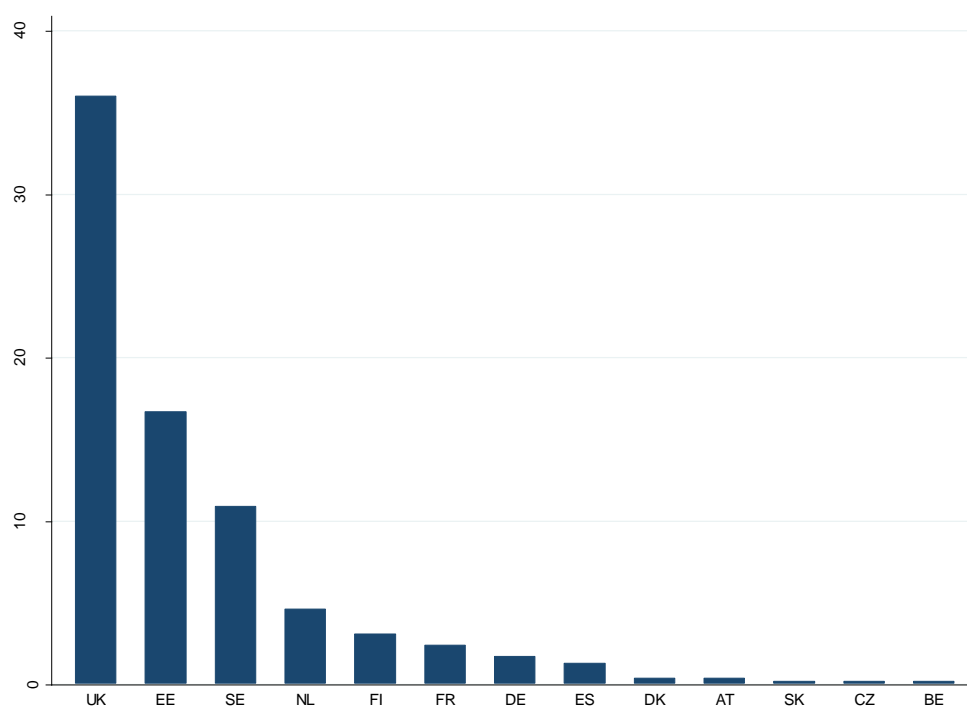
Figure 55: Access to finance – Business angels



Note: The graph represents the amount of the number of business angels per GDP (in ten thousands euro, PPP) in 2014.

Data source: European Trade Association for Business Angels.

Figure 56: Access to finance – Alternative finance

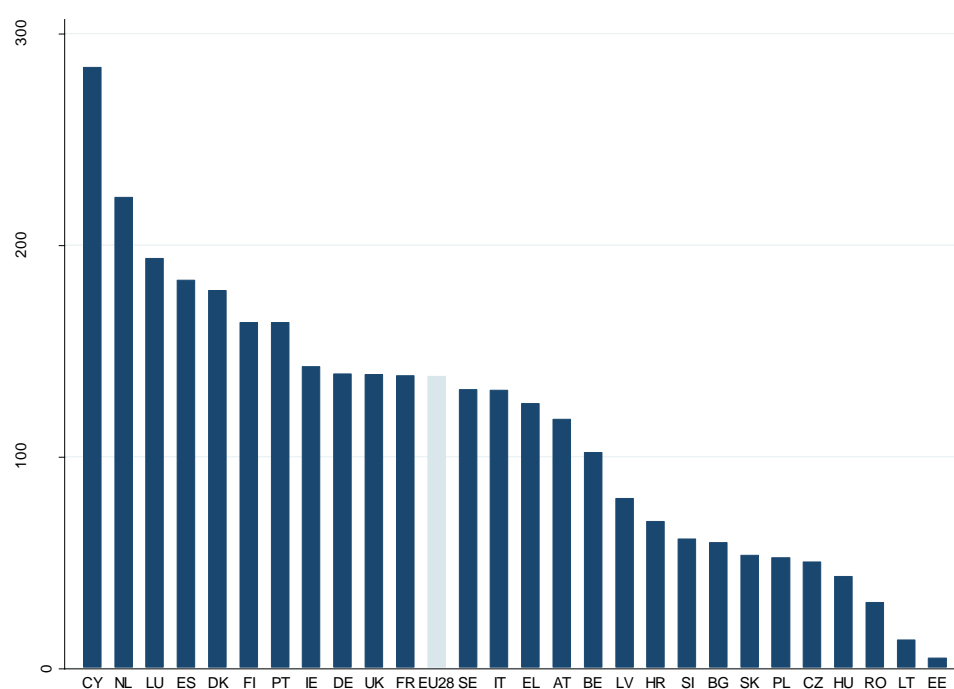


Note: The graph represents the amount of alternative finance (€ thousands) per capita in 2014.

Data source: Global Alternative Finance Data Depository (Cambridge University).

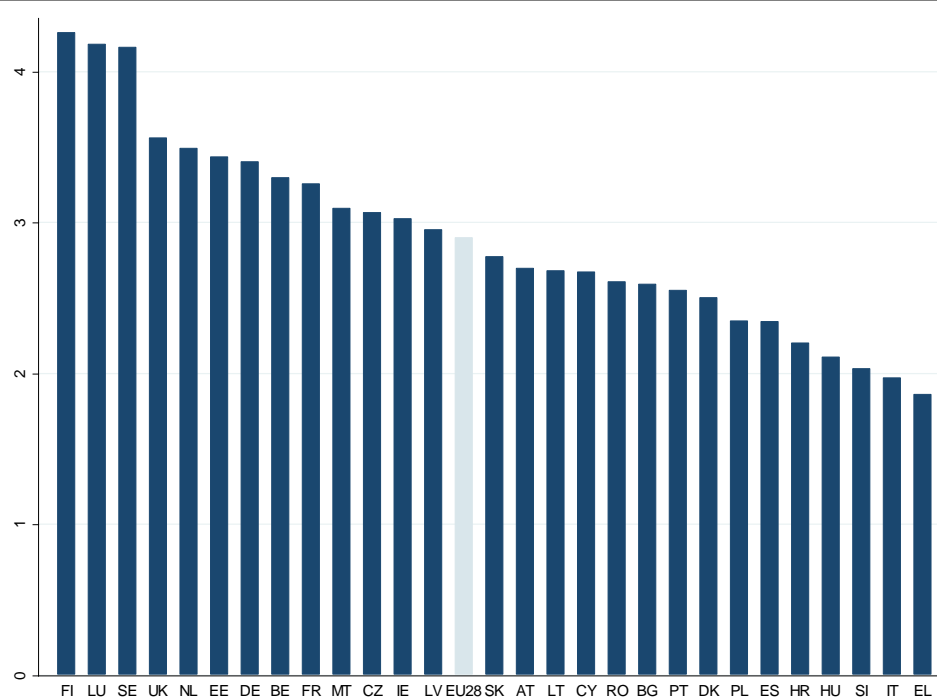
Scale-up index

Figure 57: Access to human capital – Bank credit to private sector



Note: The graph represents the domestic credit to private sector by banks (as a percentage of GDP) in 2014. Data source: IMF.

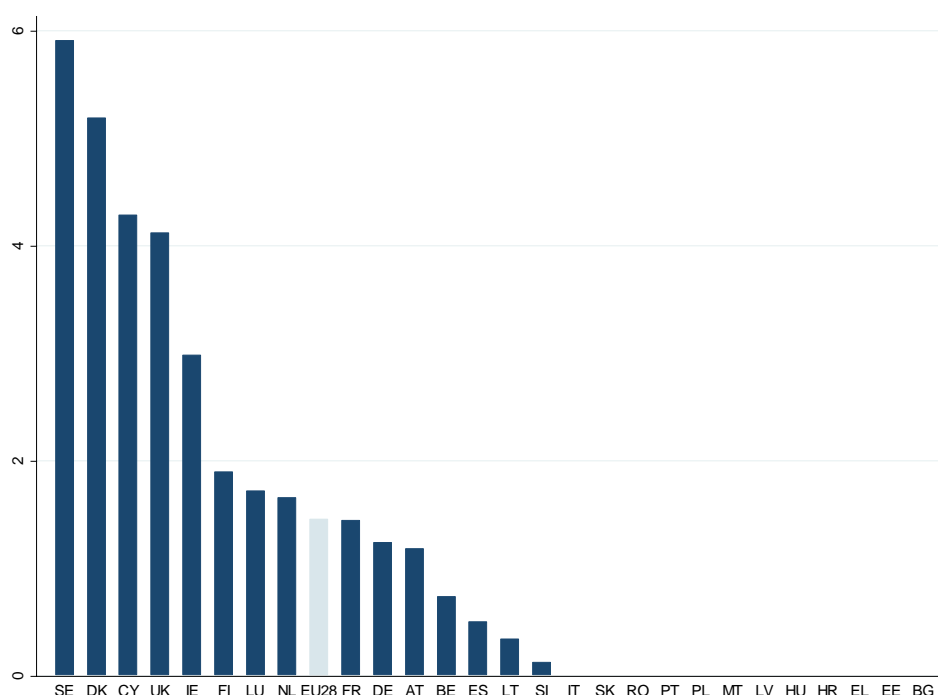
Figure 58: Access to human capital – Ease of access to venture capital



Note: The graph represents the 2013-2014 weighted average of survey responses on the question: "In your country, how easy is it for entrepreneurs with innovative but risky projects to find venture capital? [1 = extremely difficult; 7 = extremely easy]". The EU28 indicator is calculated as a population weighted average of EU28 countries.

Data source: World economic forum (WEF).

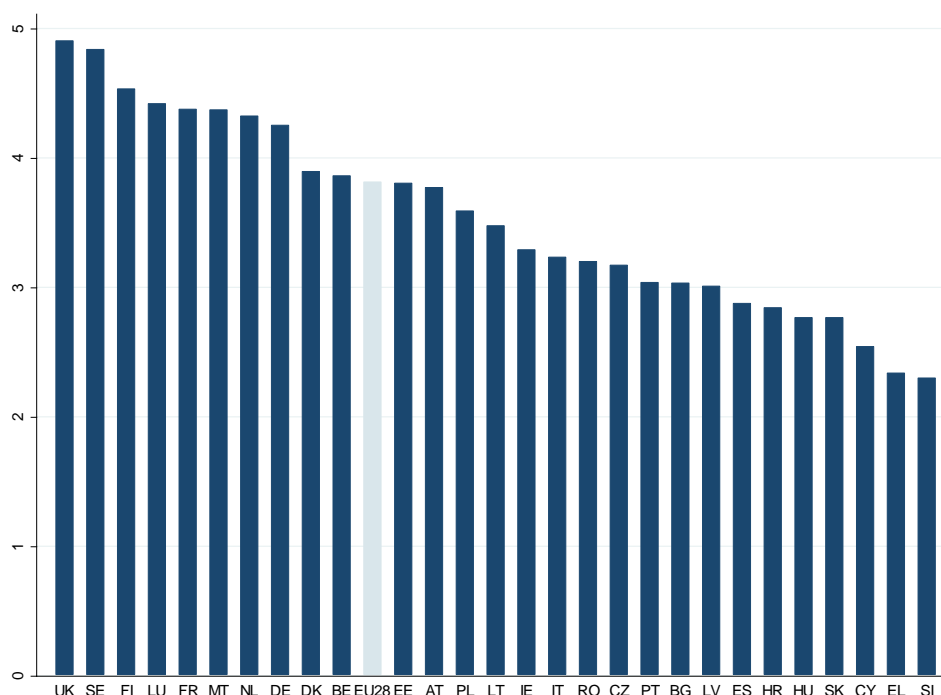
Figure 59: Access to human capital – Second and later stage VC funding



Note: The graph represents the amount of second and later stage VC funding (calculated as 3-year moving averages) per GDP (in ten thousands, PPP) in 2014.

Data source: VentureSource by Dow-Jones.

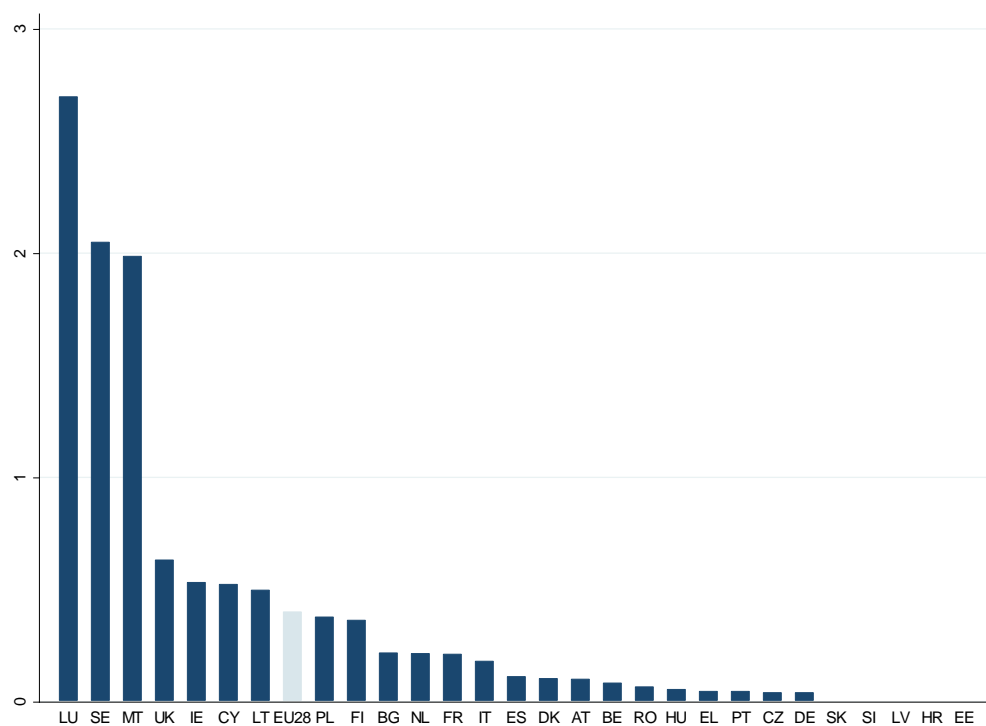
Figure 60: Access to human capital – Ease of access the equity market



Note: The graph represents the 2013-2014 weighted average of survey responses on the question: "In your country, how easy is it for companies to raise money by issuing shares on the stock market? [1 = extremely difficult; 7 = extremely easy]". The EU28 indicator is calculated as a population weighted average of EU28 countries.

Data source: World economic forum (WEF).

Figure 61: Access to human capital – Number of Initial public offerings per GDP



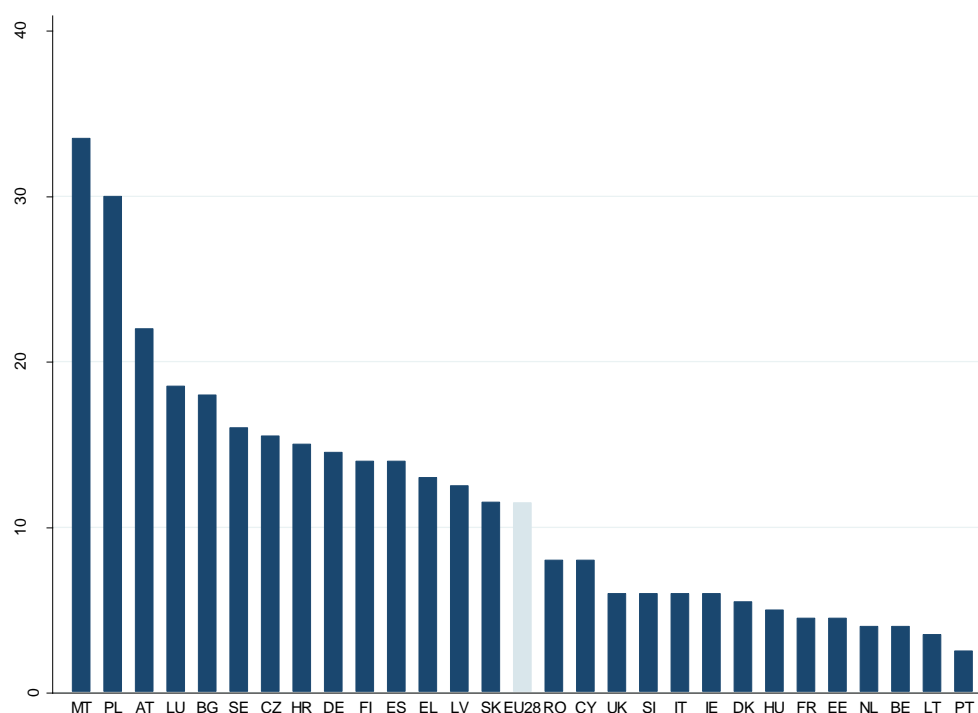
Note: The graph represents the number of initial public offerings per GDP (in ten thousands, PPP) in 2014.
Data source: Zephyr Database by Bureau Van Dijk.

Indicators on Tax and regulations

The country rankings for the indicators on Tax and regulations for the Entrepreneurship and Scale-up index are presented below.

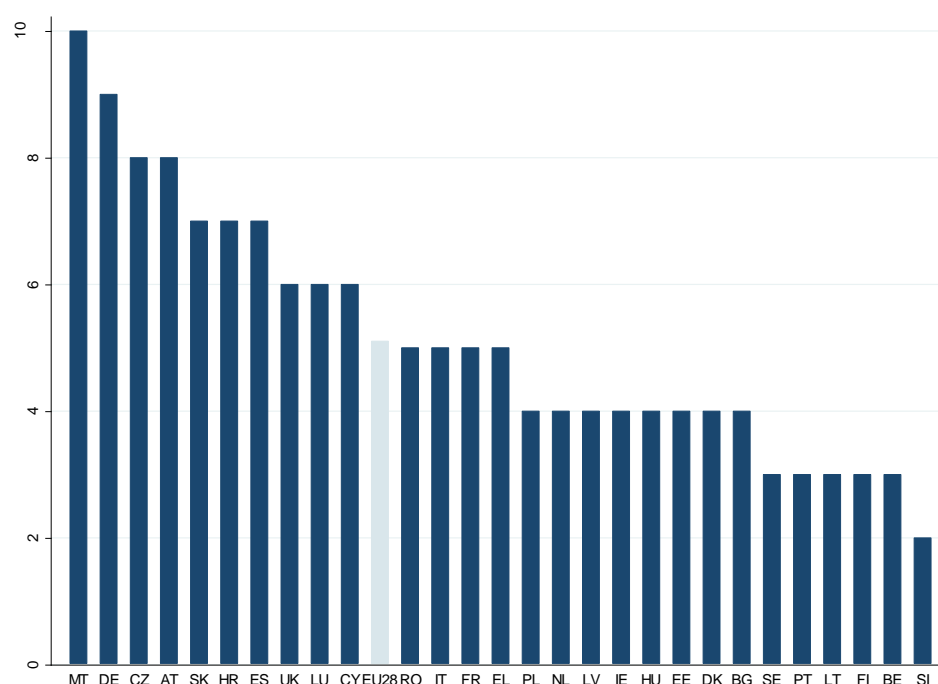
Entrepreneurship index

Figure 62: Tax and regulations – Number of days starting a business



Note: The graph represents the average time spent during each enterprise start-up procedure in 2014. Hence, in contrast to the other graphs in this report, the best performing countries are situated at the right.
Data source: World Bank.

Figure 63: Tax and regulations – Number of procedures for starting a business

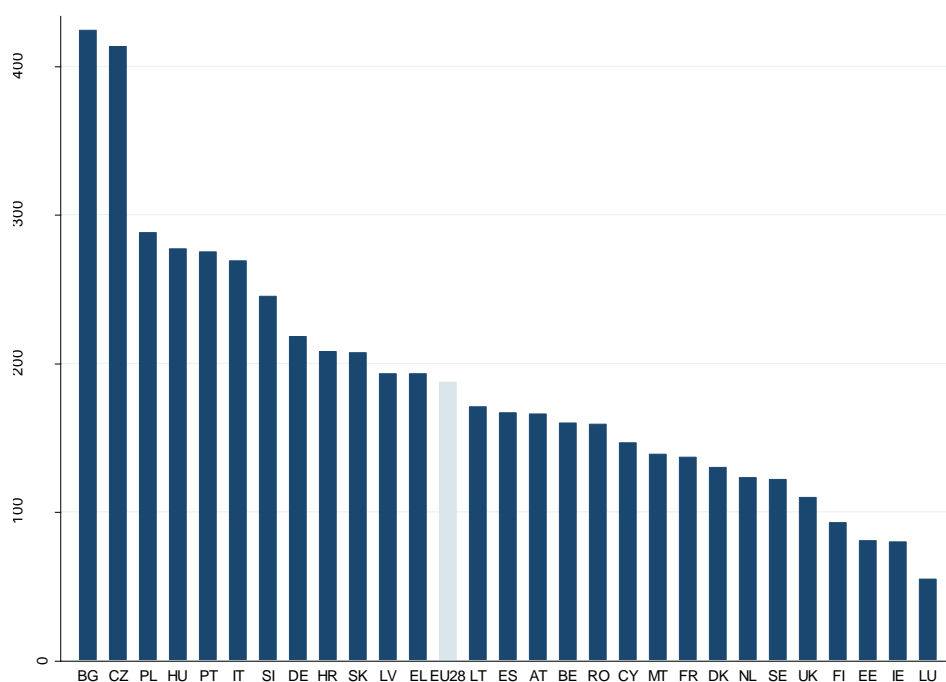


Note: The graph represents the number of generic procedures that are officially required for an entrepreneur to start an industrial or commercial business in 2014. Hence, in contrast to the other graphs in this report, the best performing countries are situated at the right.

Data source: World Bank.

Scale-up index

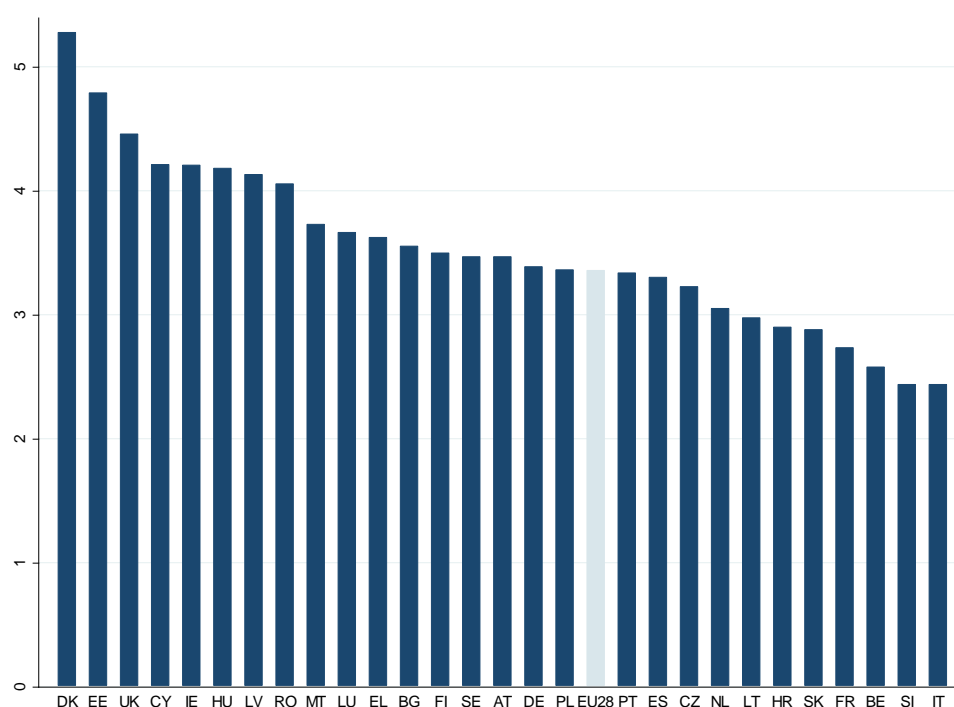
Figure 64: Tax and regulations – Time spent on tax issues



Note: The graph represents the time to prepare and pay taxes is the time, in hours per year in 2014. Hence, in contrast to the other graphs in this report, the best performing countries are situated at the right.

Data source: World Bank.

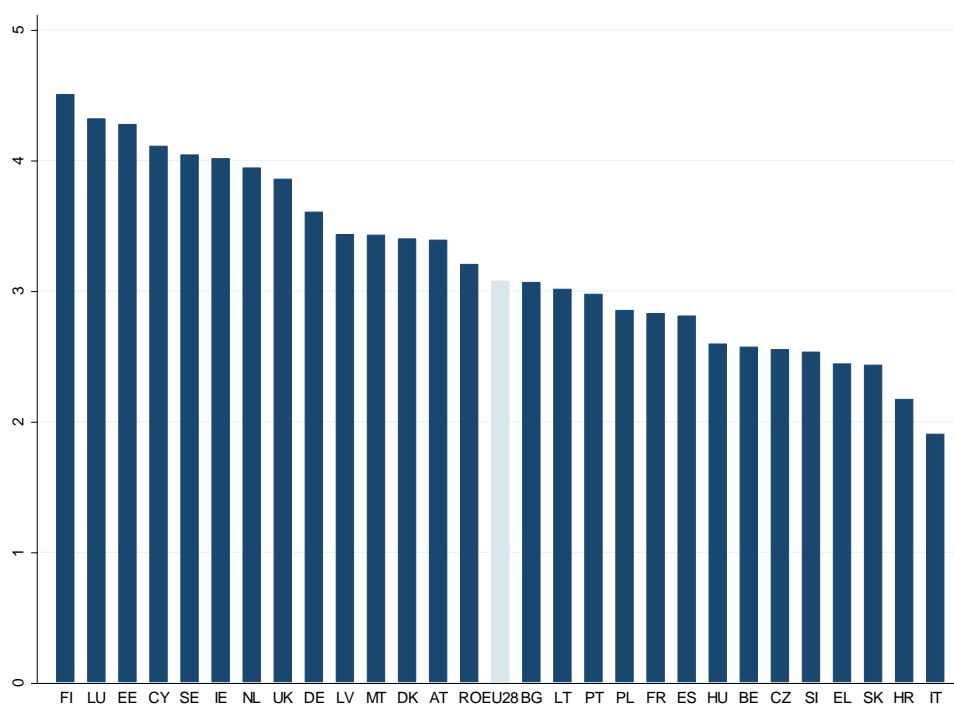
Figure 65: Tax and regulations – Hiring and firing regulations



Note: The graph represents the 2013-2014 weighted average of survey responses on the question: "In your country, how would you characterize the hiring and firing of workers? [1 = heavily impeded by regulations; 7 = extremely flexible]".

Data source: World economic forum (WEF).

Figure 66: Tax and regulations – Burden of government regulation



Note: The graph represents the 2013-2014 weighted average of survey responses on the question: "In your country, how burdensome is it for businesses to comply with governmental administrative requirements (e.g., permits, regulations, reporting)? [1 = extremely burdensome; 7 = not burdensome at all]".

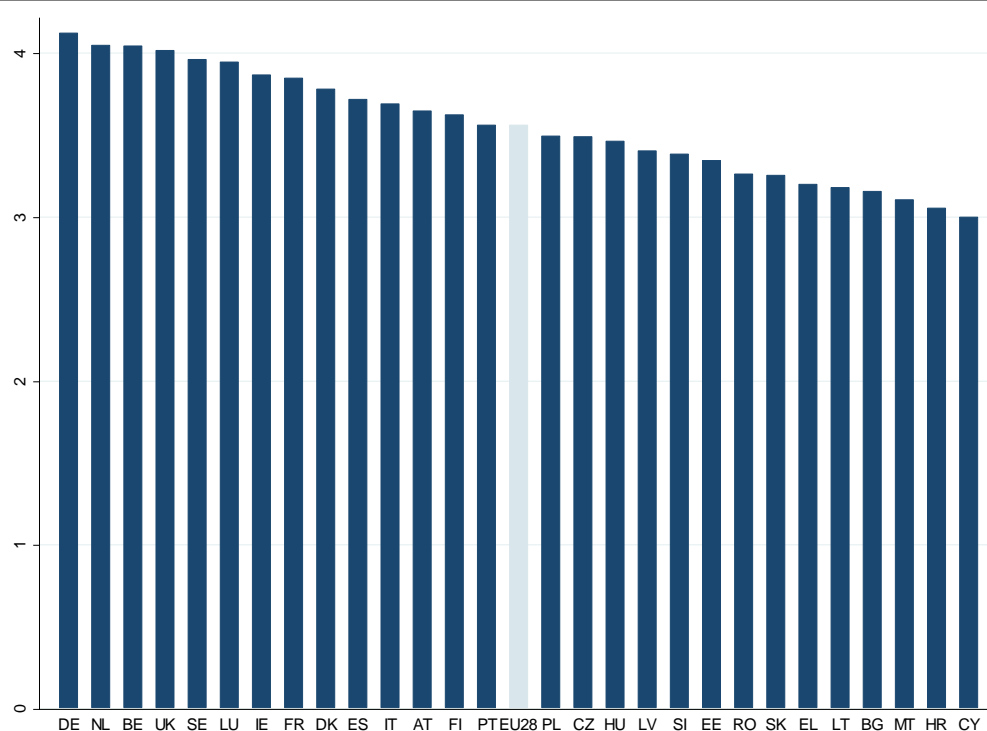
Data source: World economic forum (WEF).

Indicators on Infrastructure and support

The country rankings for the indicators on Infrastructure and support for the Entrepreneurship and Scale-up index are presented below.

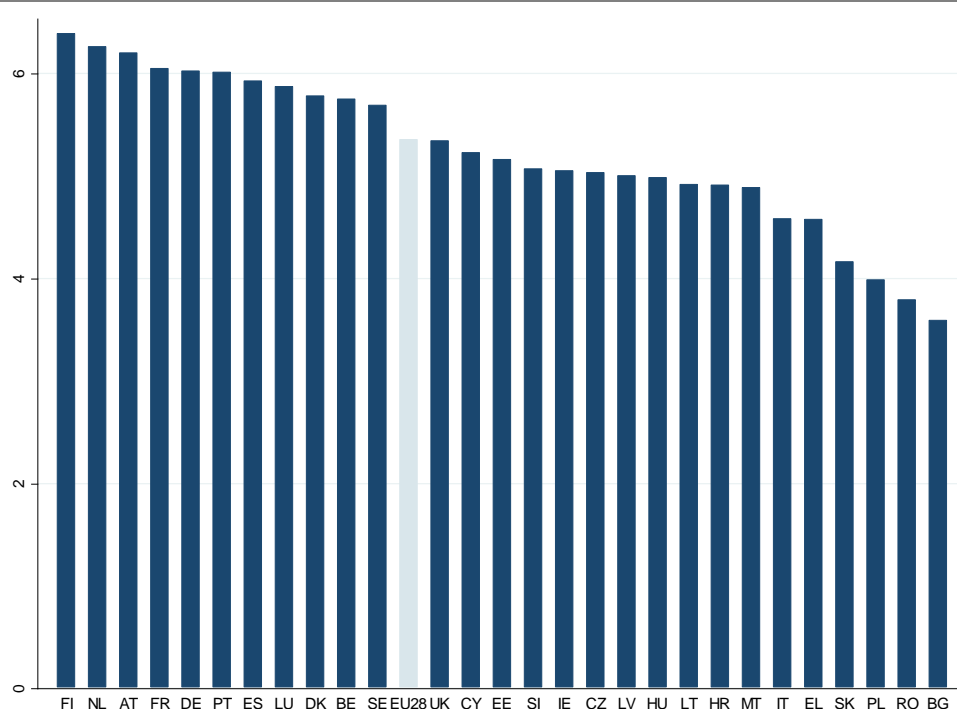
Entrepreneurship index

Figure 67: Infrastructure and supports – Logistics performance index



Note: The graph represents the Logistics performance index: Overall (1=low to 5=high) in 2014.
Data source: World Bank.

Figure 68: Infrastructure and supports – Quality of infrastructure

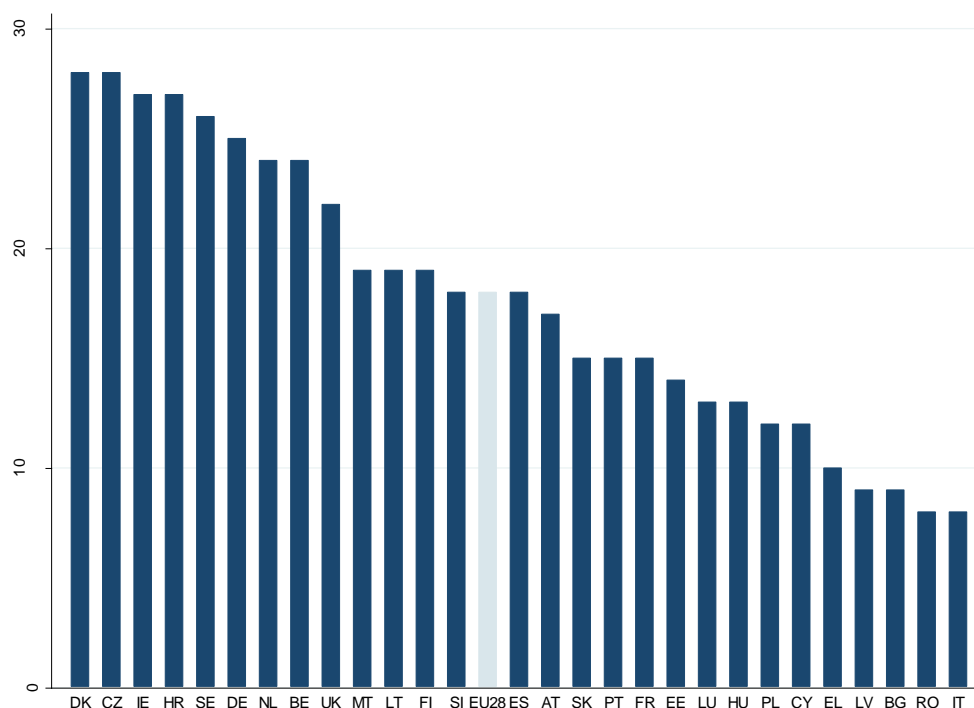


Note: The graph represents the quality of the physical infrastructure (transport, telephony, and energy) in 2014.

Data source: World Bank.

Scale-up index

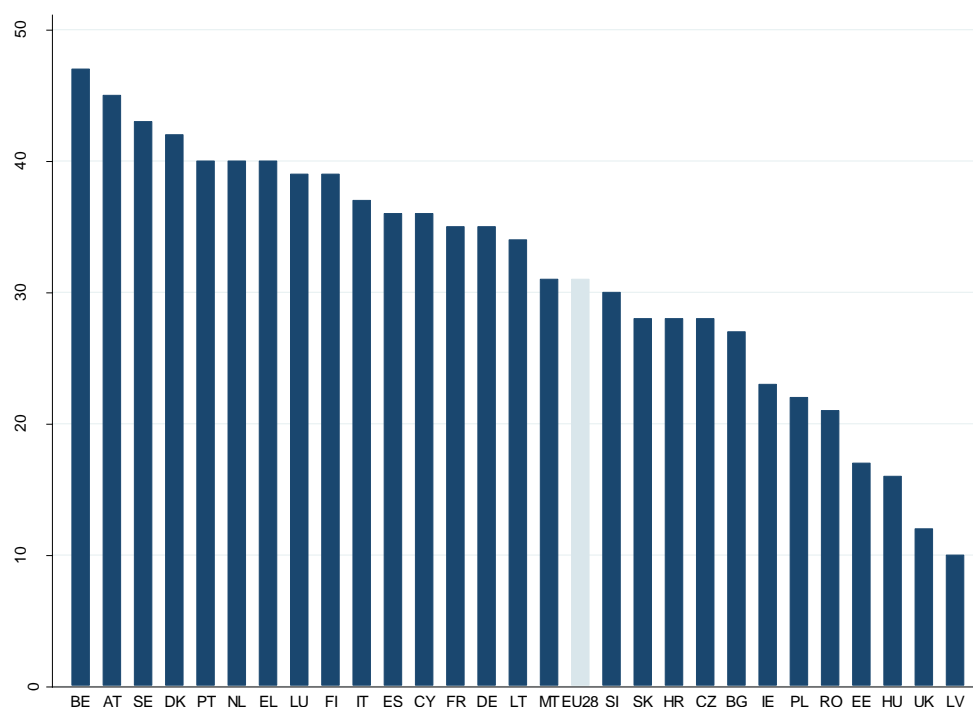
Figure 69: Infrastructure and supports – E-commerce



Note: The graph represents the percentage of firms having received orders via computer mediated networks in 2014.

Data source: Eurostat.

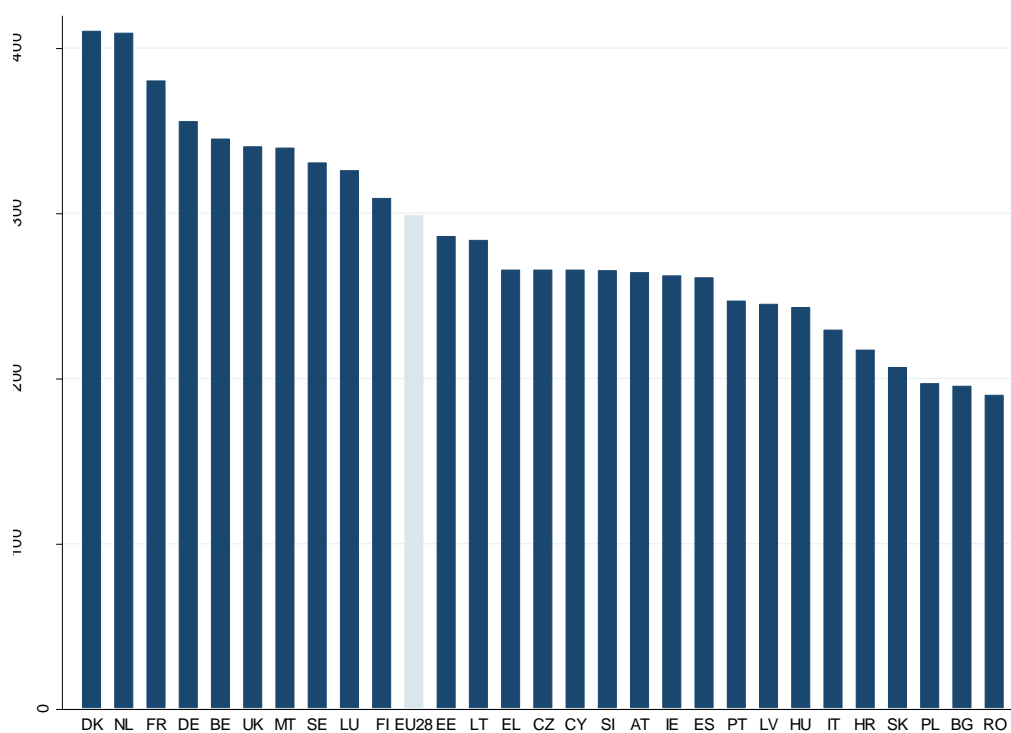
Figure 70: Infrastructure and supports – Use of ERP packages



Note: The graph represents the percentage of firms who have ERP software package to share information between different functional areas in 2014.

Data source: Eurostat.

Figure 71: Infrastructure and supports – Broadband access



Note: The graph represents the fixed (wired) broadband subscriptions (as percentage of population) in 2014.

Data source: Eurostat.

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