High Growth Enterprises in the COVID-19 Crisis Context
demographics, environmental innovations, digitalization, finance & policy measures

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Contents

Acknowledgements........................................................................................................................................6

Executive summary......................................................................................................................................7

Chapter 1 Introduction................................................................................................................................11

Chapter 2 Methods and Data ....................................................................................................................13

Chapter 3 Enterprise demographics – past, present and future..................................................................15

Chapter 4 Lessons from the Great Recession ............................................................................................26

Chapter 5 Environmental innovations and firm growth .............................................................................33

Chapter 6 Digitalization..............................................................................................................................38

Chapter 7 Financing and venture capital issues..........................................................................................42

Chapter 8 Policy Measures .......................................................................................................................57

Chapter 9 Conclusions ..............................................................................................................................61

Bibliography................................................................................................................................................63

List of Figures...............................................................................................................................................68

List of tables.................................................................................................................................................69

Annex I. Notes on data sources, indicators and their strengths and weaknesses ........................................70
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Executive summary

High growth enterprises (HGEs) make a disproportionately high contribution to job creation and economic growth. Through their frequently innovative, technology-based character, they also can have a significant impact on industrial renewal, sectoral productivity and regional competitiveness. This report – which follows on from a previous one published just before the outbreak of the COVID-19 pandemic (Flachenecker et al., 2020) – examines the EU’s economies through the lens of HGEs and those enterprises benefiting from venture capital investments which have the characteristics or aspiration to achieve very high rates of growth. Rather than merely updating the analyses presented last year, this report deepens some specific analyses, for instance regarding eco-innovation, digitalization and the role of HGEs in previous recessions and recoveries. It also updates and improves the indicator framework used to characterise country-specific framework conditions for HGEs and brings into the picture a range of different data sources which permit commentary and insights of relevance to the current crises context. The report also provides in an annex a series of factsheets consisting of snapshot graphs and figures – one for each of the EU27 member states – based on the analyses which are developed collectively for the EU in the main body of the report. The main findings and messages contained in the report are as follows:

Enterprise demographics – past, present and future

The COVID-19 crisis has uneven effects across the business economy. The six sectors that have seen their turnover index drop the most during the first wave of the pandemic between February and June 2020 are: travel agencies; accommodation; food and beverage service activities; employment activities; advertising and market research; and transportation and storage.

The share of HGEs1 in employment activities, advertising, transportation and travel agencies is higher than the EU average for the business economy. Despite the fact that it is not clear whether HGEs would react differently to this current crisis compared to ‘normal’ enterprises, a high share of HGEs in sectors at risk could indicate the possibility that the pandemic weakens a number of high-growth ecosystems. In employment terms, the share of HGE workers is particularly high for employment activities (44%), but also higher than average for food and beverage (16%), travel agency services (18%) and advertising (24%).

At the EU level, the main at-risk sectors represent 22% of HGEs – i.e. 37,000 enterprises – and 28% of the people employed by HGEs – 3.7 million workers. Regarding sectors at risk, transportation and restaurants represent the highest share of HGE enterprises, while employment activities lead the HGE employment share. On a country-specific level, Ireland has the highest share of HGEs enterprises and employees in those sectors as a proportion of all enterprises in the business economy, followed by Spain, Portugal, Slovakia and Poland. Austria, Lithuania and the Netherlands are the countries where the share of HGEs in at-risk sectors in relation to all HGEs is the highest. However, comparing countries is not straightforward as it also needs to take into account cross-country differences in COVID policies and their outcomes. Employment-wise, in the Netherlands, Belgium and Italy, around 50% of the people working in HGEs are in at-risk sectors. At first glance, coastal and Alpine locations seem to have a higher shares of “at-risk” HGEs, mainly due to tourism.

Disruptions to the creation of new enterprises or start-up might cause significant negative employment effects in the long-run. Simulations using the EU start-up calculator2 – a newly developed tool to assess the impact that a disruption of start-ups and young enterprises may have on aggregate employment – show that a strong, but short-lived crisis could generate important and persistent job losses across EU Member States: These range from 0.7% (Belgium) to 2.2% (Austria) for 2020 and could lead to massive employment lost up to 2030 (ranging from 82,000 in Belgium to 1,186,000 in Italy). For all countries considered, the negative impact is particularly high in the services sector.

1 Although the definitions of HGE varies in the report, they share a common feature: high employment and/or turnover growth sustained in time for at least 2-3 years.
Lessons from the Great Recession

The share of HGEs in overall sales growth suffers disproportionately during downturns. Analysing firm-level data from the Community Innovation Survey (CIS) for the period 2006-2014, which includes the so-called Great Recession and the subsequent European sovereign debt crisis, shows that a recession curbs firm growth across different sizes, thereby reducing the overall share of HGEs sharply. Importantly, the larger the enterprise, the heavier the recession weighs on its sales growth, both in absolute terms as well as relative to the other types of enterprises.

HGEs, especially the larger ones, boost activity considerably even during crises. Despite being disproportionally hit during crises, HGEs still significantly contribute to economic activity. The economic significance of HGEs for short-run growth is almost entirely based on large HGEs, both in phases of expansion but even more so during recoveries.

Large HGEs are significantly more prevalent in air transport, machinery and equipment manufacture, civil engineering, insurance and large part of the automotive sector. Large HGEs generally tend to be more innovative, exporters and part of an enterprise group. Finally, large HGEs received more public funding for innovation during the recovery period, even if such policy action is not statistically significant when controlling for other explanatory variables.

Environmental Innovations and Firm Growth

In light of the twin transitions that are shaping the European economic response to the current crisis and beyond, it is relevant to examine how EU enterprises could foster growth – eventually becoming HGEs – while reducing their negative environmental impact.

According to the most recent Community Innovation Survey data, there are large differences across EU countries and sectors in terms of number of environmental innovative enterprises. The share of enterprises that have adopted environmental innovation, i.e. innovations with environmental benefits, ranges from 34% in Germany to 3% in Romania. Interestingly, the relevant public support schemes (grants, subsidies, other financial incentives) are not highly correlated with the adoption of environmental innovations.

Instrumental variable estimations show that publicly supported environmental innovations positively impact firm growth in terms of turnover, employment and market share. This effect varies across different countries and sectors, suggesting that public support for environmental innovations supports firm growth across economic sectors and Member States.

Implementing publicly-supported environmental innovations also increases the likelihood for enterprises to become HGEs. The magnitude of the effect varies according to different HGE definitions, but remains statistically significant.

In the EU policy mix, environmental innovation is part of a broader set of “green” policies which still could benefit from a more coherent, systematic reorganisation. Public financial support for environmental innovation is sparse among different EU budget instruments and lies under a broader umbrella of green policies. Apart from a strategic re-focus of the funding, targeting enterprises based on their size and innovation experience could be beneficial.

Digitalization

The level and peculiarities of the digitalization processes among EU enterprises, distinguished by different growth profiles was explored based on data from the EIB Group Survey on Investment and Investment Finance (EIBIS) 2019 and the Flash Eurobarometer 486 published in 2020.

The share of HGEs having adopted digital technologies varied greatly among EU Member States, ranging from 83% Slovakia to 32% in Latvia according to EIBIS data. The EU HGE average was 70%, which is higher than the relative performance of non-HGEs. Western European countries generally perform above average, with the exception of Italy and Greece, while Eastern European ones generally display lower scores.
According to the Flash Eurobarometer 2020, enterprises that plan high-growth in the next few years value digitalization as an engine for their growth process more than enterprises that have lower growth expectations. The only country where this clearly does not happen is Hungary. In general, the share of enterprises planning high-growth that view digitalization as a driver for their growth in the EU is lower than in the US and the UK (31% vs 41% in each).

The shares of EU growth enterprises adopting advanced digital technologies are lower than in the US and the UK in almost all the relevant technology domains: cloud computing (51% EU vs 65% US/UK average); high-speed infrastructure (36% vs 46%); smart devices (26% vs 36%); big data analytics (14% vs 18%); and artificial intelligence (8.5% vs 9%). The only positive exceptions are Sweden, Netherlands, Spain and Ireland.

**Financing and Venture Capital Issues**

According to the results of the latest Survey on the access to finance of enterprises in the euro area (ECB SAFE Survey, 2020), bank finance is by far the main source of finance for most enterprises (small, HGEs, and large companies). HGEs consider all of the listed financing instruments to be more relevant compared to other types of enterprises (both large and SMEs), suggesting that they need to raise funding from a variety of sources of finance. Only a small proportion, 14.5%, of HGEs headquartered in EU27 countries seeking external finance avail of VC (ECB SAFE Survey, 2020).

The COVID-19 pandemic has created a significant systematic economic shock, as did the above-mentioned Great Recession or Global Financial Crisis even though there are big differences between the two. Given the importance of the entrepreneurial finance market for the economy, the impact of the current pandemic on the European VC market is assessed using Pitchbook and a novel source of real-time data provided by Dealroom.co.

On the investment side, the category of finance most severely hit by the pandemic is seed and early finance deals, whereas late-stage deals have shown much greater resilience.

VC for “business and consumer products and services” was the area most heavily affected by the crisis. Enterprises focused on the tech sectors and healthcare, instead, seems to benefit from the current crisis, as their deal-values have been rising.

On the whole, VCs have been showing more concern for their portfolio companies, rather than for new investments. Apart from the third quarter of 2020, business angel investors continued to invest in start-ups, although the number of deals fall drastically.

**Policy Measures**

Across the EU, swift policy action has provided liquidity and employment support that is crucial to withstand the negative economic effects of the COVID-19 pandemic crisis. In the early phase of the crisis, policy-makers focused on immediate issues such as employment preservation and liquidity assistance, especially through tax deferrals, wage subsidies and loan guarantees. The implementation of a diverse array of measures has helped to mitigate liquidity risks for the business sector in general. However, it should be noted that not all of these measures are equally suited to support aspiring and existing high-growth enterprises, especially firms in their scale-up phase. These require programmes that are more tailored to their specific profile and financing needs.

Going forward, the policy response should not only focus on the immediate survival of viable firms, but also on deploying longer-term measures geared to strengthen the HGE ecosystems in the European economies. These range from providing the right framework conditions that will help HGEs to grow to addressing country specific bottlenecks, such as improving access to finance or increasing the skill levels of the workforce. In this regard, and as an example on the European level, the Recovery and Resiliency Facility (RRF) provides an important reform and investment impetus to foster the digital and ecological transition in Europe that will not only improve the framework conditions for HGEs and aspiring HGEs, but also create new business opportunities for entrepreneurial activity.

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3 In terms of intensity, speed of onset, sectors affected, strata of society impacted, etc.
Chapter 1 Introduction

More than one year after the onset of the COVID-19 pandemic, as the world looks with hope to the new vaccines to eventually bring the devastation of human life under control, the urgency to re-establish normal and sustainable socio-economic activities will become an increasingly dominant public policy priority alongside health. The health emergencies during the pandemic in terms of shortages or lacks of equipment, treatments, facilities, etc. gave rise to many examples worldwide of the possibility for private enterprises to step into the breach and meet quicker than what many thought possible some of the needs and demands which were sudden, massive and totally unexpected. Perhaps the best example is the speed at which companies with research institutes from around the world have been able to develop and obtain approval for different vaccine candidates. Looking ahead, more generally, private enterprises across all sectors of the economy drawing on science and innovation, should provide responsible and sustainable goods and services which will drive the employment growth and prosperity needed to recover from the pandemic-induced recession and to avoid a prolonged depression. High growth enterprises can be expected to play an important role in this.

The importance of high growth enterprises (HGEs) – often highly innovative and technology-based – in recovering economic normality, helping to reverse the negative impacts of COVID-19, cannot be overstated. It resides in the disproportionally high contribution – in times of crisis and recovery as much as in more normal conditions - of HGEs to job creation [see Henrekson & Johansson (2010) and references therein], as well as their impact on industrial renewal, sectoral productivity and regional competitiveness.

The policy response at different levels in EU to the impact of the crisis on businesses has initially catered for the liquidity needs and survival of the general business population. Unfortunately, such a blanket approach can result in a blind spot whereby the specific needs of HGEs and the future supply of such enterprises from the pipeline of innovative, often technology-based start-up and scale-up enterprises are neglected. Indeed, the frequently operating at a loss situation of such high-potential enterprises can disqualify them from availing of much of the emergency financial support mobilized by governments (Mason, 2020). In other words, pre-crisis business financing deficiencies already constraining HGE development (Flachenecker et al., 2020) are being exacerbated by a combination of crisis-induced falls in revenues, declines in the availability of private equity and debt finance and policy neglect. If anything, a far-sighted policy should prioritize measures aimed at these deficiencies in order not to forego the high potential economic gains in terms of jobs, taxable revenues, know-how and innovation of this category of enterprise which the economy needs both now and in the recovery phase.

The analyses of HGEs and related issues contained in this report aim to inform policy responses at EU and Member State level. While the context is dominated by the response to the pandemic – notably the mainstreaming of the Recovery and Resilience Facility mainstreamed into the European Semester process for economic policy coordination – it is important to keep in mind several significant policy priorities established before the pandemic broke such as the twin green and digital transitions and the new industrial strategy (especially the SME component of this), which take on heightened significance in the current situation. This report is a follow-up to a previous JRC report (Flachenecker et al., 2020) on HGEs designed to provide input to individual Country Reports as part of the 2019-20 cycle of annual European Semester process. It provided an overarching descriptive analysis of HGEs, their economic importance and policy-related factors that facilitate or constrain their development as well as country-specific factsheets for 21 EU Member States. A core set of HGE indicators – or HGE indicator framework – was central to this first report.

This present follow-up report develops some more selective and deeper analyses in tune with current EU policy priorities (e.g. environmental innovation to foster firm growth, related to the European Green Deal). In particular, the report provides information on how HGEs might have been impacted by the COVID-19 pandemic. This includes an in-depth overview of the HGE share in the most impacted sectors and a spotlight on disruptions of start-up activity and its impact on aggregate employment...
(Chapter 3), the dynamics of HGEs during previous crisis periods (Chapter 4), the development of important financing sources for HGEs, e.g. business angels and venture capital markets, during the pandemic (Chapter 7) and a short overview of the national policy response to support the business economy including aspiring and existing high-growth enterprises (Chapter 8). Additionally, the report provides evidence of the longer-term structural transitions that need to be addressed, in particular to the role that eco-innovations play for firm growth (Chapter 5) and the degree of digitalisation of HGEs (Chapter 6). The report also contains a revised indicator framework and short factsheets for all 27 EU Member States.

The effort to shed light on HGE-related issues relevant to the COVID-19 pandemic policy response entailed drawing on relevant available data and analyses beyond the indicator framework in order to increase the timeliness of the findings. The consequence of this is that the reference definitions of HGEs and the time periods covered vary from section to section, as discussed in detail in Chapter 2. This may result in a less coherent narrative than might ideally be wished for. However, the net result of the trade-off between coherence and timeliness is arguably positive given that policy development and decisions have to be made on the basis of the most up-to-date available information and insights however incomplete and fragmented they might be.
Chapter 2 Methods and Data

This Chapter provides an overview and assessment of the methodology and data used in this report and the Member State (MS) factsheets. Note also that Annex 1 provides an update on data sources and a discussion of the strengths and weaknesses of the indicators derived from the data. In addition, the reader is referred to Chapter 2 and Annex 2 of the previous JRC Technical report on High Growth Enterprises (Flachenecker et al., 2020) for more detailed descriptions outlining strengths and limitations of the methods and data.

Methodological framework. Definition of high growth enterprises

In terms of methodology, there are three important developments compared to (Flachenecker et al., 2020). Firstly, the relative rigour (compared to last year’s report) of the HGE definition has been loosened. Secondly, the report relies on a broader spectrum of analytical tools, ranging from descriptive analyses, scenario analysis (start-up calculator) and the econometric modelling used in Flachenecker et al. (2021a). Finally, with respect to the need for insights of relevance to the current crisis, specific attention is given to data availability and the time period to which they refer.

The decision to draw on additional sources of information is motivated by the aim for increased policy relevance. However, the breadth of more up-to-date information comes with a trade-off in precision, since different data sources use varying definitions for HGEs and/or notions of growing enterprises, potential HGEs, etc.4

Chapter 3 on enterprise demographics (as well as section 1 of the MS factsheets) uses the Eurostat HGE definition – i.e. enterprises having (i) experienced an annualised average employment growth rate of 10% per year over a three-year period5 and (ii) at least 10 employees at the beginning of the growth period. This is in line with Flachenecker et al. (2020).

More diffuse notions of HGEs are employed in Chapter 4 discussing lessons from the great recession, and in Chapter 5 discussing the relationship between environmental innovation and firm growth, as well as in sections 3 and 5 of the MS factsheets, where two different definitions are used according to the data source. Analysis using Community Innovation Survey (Eurostat) data also entails a variation on the above definition by referring to growth of average annualised sales of 10% over a three-year period. A more important difference in definition comes with the analyses based on Eurobarometer survey data for which HGEs are enterprises with at least 30% revenue growth in the last 2 or 3 years6.

Chapter 7 dealing with financing and venture capital issues as well as section 2 of the MS factsheets draws on the European Central Bank’s Survey on Access to Finance of Enterprises (ECB SAFE Survey, 2020) according to which a HGE is an enterprise with an average annualised turnover growth of 20% per annum over a three-year period. Finally, European Investment Bank’s Group Survey on Investment and Investment Finance, which feeds into the HGE indicator framework presented in the MS factsheets defines HGEs as companies having three years of employment growth above 33% (i.e., equivalent of three consecutive years of a 10% annual growth rate) and number of employees of at least 10 at the beginning of the period.

Research methods

Throughout the report, mostly descriptive analyses are used. These are based on simple indicators taken directly from data sources or derived from them mostly as ratios of two pre-existing indicators. Arithmetic means are computed to compare HGE distributions over time and member states. Distributional analyses (quartiles) across enterprise size and enterprise growth rates are performed

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4 Some data sources do not refer to HGEs per se in which case we used as proxies other concepts (e.g. growing enterprises).
5 In line with the data sources, the report uses an average annual (employment or turnover) growth of 10% over a two or three year period, rather than >20% that the OECD definition stipulates.
6 While Flash Eurobarometer 315 uses a two year span, Flash Eurobarometer 486 uses a three years one.
to assess the contributions of HGEs to overall economic growth. In addition to these elements, the MS factsheets include several standardized indicators compared to EU averages.

The chapter based on Flachenecker et al. (2021a) provides a description of the results of an econometric analysis based on two stage least squares (2SLS) and instrumental variable (IV) estimation on a panel of micro-data related to environmental innovation.

Finally, the start-up calculator work cited draws on Benedetti Fasil et al. (2020c, 2020a, 2020b) in which a simulation tool is used to compute an estimate of the medium-run (up until 2030) impact that COVID-19 may have on aggregate employment via the disruption of start-ups and young enterprises. It is based on a macroeconomic model and publicly available data from Eurostat Business Demography Statistics allowing analysis of the whole economy, as well as the industrial and service sector in each MS.\(^7\)

**Time-horizon of the analysis**

As a general rule, the analyses in the report use the most recent data available. Given the variety of the topics covered as well as data availability, “the latest year” varies between 2014 and 2020. While Chapters 6, 7 and 3.2 dealing with digital transformation, financing and the start-up calculator use 2019 and 2020 as the most recent data, Chapters 4 and 5 covering lessons from the Great Recession as well as environmental innovation use 2014 as the most recent year related to the relevant chapters of the Community Innovation Survey (Eurostat). Finally, Chapter 3.1 analysing economic sectors with a high exposure to the Covid-19 crisis is based on Eurostat data with 2017 and 2020 as the latest years. The MS factsheets use 2011 and 2016 data as the latest for two of the environmental innovation indicators reported. The factsheets refer also to the results of country-specific simulations of the impact of Covid-19 using the EU start-up calculator, when available.

We are aware that using older data weakens the policy relevance of the analysis. This may concern in particular parts of the results on environmental innovation and lessons from the Great Recession. However, according the previous paragraph, relevance of policy messages based on the other sections of the report is less or not at all influenced by the “age” of the underlying data. Nevertheless, we believe that some specific issues would clearly benefit from more recent data.

**Data**

The number of data sources used in the present report and the MS factsheets has increased significantly compared to Flachenecker et al. (2020). In case of venture capital, a new data source is used and this has brought about improvements in the analysis. These developments add to the strength of the report, because the increased amount and quality of information included is conducive to more and relevant policy messages. However, proliferation of data sources carries some unavoidable risks and possible weaknesses related to data comparability and increased difficulties in the development of an integrated, unitary narrative. We describe and assess the new developments in data usage in Annex I.

\(^7\) See also the interactive on-line tool and more technical details at https://ec.europa.eu/jrc/en/covid-19-start-up-calculator
Chapter 3 Enterprise demographics – past, present and future

In addition to its terrible toll on human life and health, the COVID-19 pandemic is also having a major negative economic impact in the EU and worldwide. The crisis has an asymmetric impact on various economic sectors, some of them being rather vulnerable and hit significantly more severely than others. These sectors are defined in this chapter as being “at risk”. The evolution of the short-term impacts of the crisis within vulnerable and less vulnerable sectors whether receding or accentuating, having reversible or irreversible consequences is very difficult to anticipate as it is highly dependent on what course the on-going pandemic will take. However, at an aggregate level and indirectly, it is possible to simulate likely effects on entrepreneurial activity that can have long-lasting consequences for future HGEs. The chapter is divided into two parts: the first provides a general discussion of sectors at risk on the EU level, the second discusses the impact of the crisis on start-ups and its implications for employment.

EU wide discussion of sectors at risk

In the first wave of the pandemic, economies operated 25-30% below capacity during the strictest phases of confinement or lockdown imposed by EU member state governments. The European Commission (EC) projected EU GDP in 2020 to fall by 7.4% and the unemployment rate to rise from 6.7% to 7.7% (European Commission, 2020e). In its winter 2021 (interim) forecast, the EC forecast 3.7% EU GDP growth for 2021 and 3.8% for 2022 (European Commission, 2021a).

While the entire economy is suffering, some sectors and types of enterprises are affected more severely than others. EU SMEs reported an average 50% turnover loss during the lockdown period (SME United, 2020) and the industry part of the EU economic sentiment indicator dropped by 26.1 points between February and April 2020 (European Commission, 2020c). HGEs, which are important job creators and innovators, are being hit as well though it is difficult to discern exactly to what extent at this stage. One way to get a sense of this impact on HGEs in the short term is by looking at the HGE components of the sectors most hit by the crisis. Statistics permit such a vulnerability assessment country by country and region by region.

The methodology used is similar to the one using employment data at provincial level to anticipate the potential variable impact by sector of COVID-19 on local employment for the US and Spain (Teruel, 2020). The first step, identifying the sectors most at risk, was initially based on Moody’s analytics (Zandi (2020)) for which “mining”, “transportation”, “employment services”, “travel arrangements” and “leisure and hospitality” were the sectors most economically vulnerable to COVID-19. These sectors largely coincide with EU Industrial ecosystems having the lowest confidence indicators during the pandemic (European Commission, 2020a). They also match Italian sector-specific risk measures provided by the Istituto Nazionale Assicurazione Infortuni sul Lavoro (INAIL, 2020). The NACE codes corresponding to Moody’s analytics sectors at risk are: Mining (NACE B), Transportation (NACE H, excluding postal activities), Employment Services (NACE N78, 781, 782, 783), Travel Arrangements (N79, N791, N799), Leisure and Hospitality (NACE L for hospitality and food services, NACE R for leisure, not present in HGEs statistics).

The next step in this analysis was to adapt the choice of “sectors at risk” in light of EU level data on sales of the industries, in order to have a more precise, evidence-driven and targeted approach. Sectors with the largest drops in enterprise revenues from February to June 2020 largely coincide with the initial identification of such sectors (above), except for “Mining” and “Advertising and market research” (NACE M73; not included in Moody’s). The final choice includes the sectors for which the

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8 [https://www.brookings.edu/blog/the-avenue/2020/03/17/the-places-a-covid-19-recession-will-likely-hit-hardest/](https://www.brookings.edu/blog/the-avenue/2020/03/17/the-places-a-covid-19-recession-will-likely-hit-hardest/)
9 Another example contemplated but not used because it was restricted to the tech sector was developed by DealRoom and Sifted, using share prices to detect “net positive”, “defensible”, “vulnerable”, “most affected” sectors due to COVID-19
10 Our focus is on outlining the negative risks pertinent for selected sectors of the economy. However, some of those have benefitted from a positive COVID-19 effect (economically speaking), e.g., e-commerce - see Figure 1
drop in turnover index (February 2020=100) was larger than 20% (11 sectors considered) and where data on HGEs is available (6 sectors considered). The resulting sectors “at risk”\textsuperscript{11} are depicted in bold in Figure 1\textsuperscript{12}.

On the flip side of the coin, we observe sectors that managed to profit mostly from sales of products matching the changing consumer behaviour, especially on-line retail which can be considered as being the biggest winner. In addition, audio and video equipment retail, ICT equipment and household equipment retail, on-line cultural and recreation goods have also managed to perform pretty well. From among the two high technology manufacturing sectors pharmaceuticals has logically maintained its performance. On the other hand, manufacture of computer, electronic and optical products has been slightly more affected, but fared better than more medium-high, medium- or low-tech sectors (Figure 1).

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure1.png}
\caption{Index of turnover (February 2020=100) per NACE rev.2 sector, total, seasonally and calendar adjusted data, EU27 Data source: Eurostat. The data displays the values per sector (corresponding to the different lines) of turnover index during the period February–June. In bold, sectors (or macro-sectors) chosen as the most at-risk-sectors based on turnover decrease and HGE data availability}
\end{figure}

Irrespective of whether there may be long term negative consequences for these sectors (for the majority, Eurostat data show rebound effects in revenues), in order to obtain a first impression of what the short-term impacts could amount to, including how this varies across countries and regions, we cautiously assume that the impact on HGEs is in some way proportional to the size of the HGE component in these sectors\textsuperscript{13}.

Table 1 shows 2017 figures for the share of HGEs both in the total number of enterprises and in the total employment for each sector “at risk”. It reveals wide variability across the EU from 0 to over 77% and gives a sense of the relative importance of HGEs for each of these sectors by country. The share of HGEs of the total business economy is also included as benchmark.

\begin{table}[h]
\centering
\begin{tabular}{|l|l|l|}
\hline
Sector & HGEs in total enterprises & HGEs in total employment \\
\hline
Food and beverage service activities & & \\
Travel agency, tour operator and other reservation service and related activities & & \\
Retail sale via mail order houses or via Internet & & \\
Retail sale of audio and video equipm. & & \\
Retail sale of ICT and other household equipm. & & \\
Manufacture of pharmaceuticals & & \\
Manufacture of computer, electronic and optical prod. & & \\
Transportation and storage & & \\
Employment activities & & \\
Advertising and market research & & \\
Accommodation & & \\
\hline
\end{tabular}
\caption{Table 1. Share of HGEs in total enterprises and employment by sector “at risk”}
\end{table}

\textsuperscript{11} See also European Commission (2020b) for a similar sectoral selection.
\textsuperscript{12} For further clarity, “Employment activities” include personnel search, selection referral and placement activities, activities of casting agencies and bureaus and other human resources provision
\textsuperscript{13} Actually, the negative impact will not be the same for all enterprises in a given sector. Previous crises had a disproportionally negative short-term impact on HGEs (Flachenecker et al., 2018), which, if applicable to COVID-19, means that this simple approximation underestimates the real impacts, in addition to not considering potential negative impacts on HGEs in other sectors. Assuming homogeneous impact across countries and regions is also an important simplification of the analysis due to different economic characteristics of the territories and restriction policies adopted
Table 1. Number of HGEs and corresponding employment shares in COVID-19 risk-related sectors (largest turnover drop) as percentages of the totals for each sector (i.e. enterprises with 10 or more employees), with greener shading for low values and redder shading for high values (3-colours scale per overall share distribution). Source: Eurostat, 2017

<table>
<thead>
<tr>
<th>Sector</th>
<th>Number of HGEs</th>
<th>Employment shares</th>
<th>Total business economy</th>
</tr>
</thead>
<tbody>
<tr>
<td>Advertising and market research</td>
<td>14.45</td>
<td>24.29</td>
<td>13.6</td>
</tr>
<tr>
<td>Transportation and storage</td>
<td>13.84</td>
<td>15.6</td>
<td>14.6</td>
</tr>
<tr>
<td>Accommodation</td>
<td>8.59</td>
<td>15.7</td>
<td>16.3</td>
</tr>
<tr>
<td>Food and beverage services</td>
<td>16.45</td>
<td>10.5</td>
<td>11.9</td>
</tr>
<tr>
<td>Travel agency services</td>
<td>12.66</td>
<td>17.9</td>
<td>19.4</td>
</tr>
<tr>
<td>Total business economy</td>
<td>15.21</td>
<td>27.2</td>
<td>30.4</td>
</tr>
</tbody>
</table>

The EU average share of HGEs in accommodation, food and beverage services is less than the overall average share of HGEs in the business economy of around 11%. The situation is different for advertising and market research (14.5%), transportation and storage (14%), travel agency services (12%) and, particularly, employment activities (22.5%). In these cases therefore, the size of potential short-term impact of COVID-19 is higher than for the business economy at large. The situation is even more interesting concerning the employment share of HGEs. The EU average share of employment in HGEs is 15% for the business economy, which is higher than the average value for transportation, storage and accommodation. However, for food and beverage (16%), travel agency services (18%), advertising and market research (24%) and employment activities (44%) the higher values mean a likely higher number of HGEs employees potentially negatively impacted by COVID-19, especially in employment activities. Overall, the share of HGEs in sectors at risk is larger than 10% for all the sectors considered. Noteworthy country-specific observations:

- For Ireland the HGE part of the potential COVID-19 impact is high, notably in the advertising and market research sector
- For Spain, Portugal and Greece, a significant part of the potential COVID-19 impact on HGEs lies in the tourism industry, and for Spain and Portugal, in employment activities, too
- Italy, in contrast, employs less people and has fewer HGEs in these sectors at risk, with the exception of advertising and employment activities for which it has the highest share of HGEs employees (77%)
- While the share of HGEs in the food and beverage services is relatively low EU-wide compared to other sectors, the share of employees is high, especially in Slovenia, Slovakia, Latvia, Portugal and Croatia (all above 22% of employees)
- Spain is one of the countries with the highest share of HGE employees in sectors such as advertising (26%), transportation (28%), accommodation (19%), food and beverages (22%) and employment activities (72%). Slovenia has the highest shares for transportation and storage (18%), food and beverage (23%), employment activities (74%) 
- Countries generally facing the least potential negative impact for these sectors at risk are Romania, Denmark, Estonia and Belgium. 

In addition to intra-sectoral dynamics, we can also illustrate the relative importance of these sectors at risk with respect to the whole HGE population.
As shown in Figure 2, at EU27 level, the main at-risk sectors from COVID-19 represent 22% of HGEs - i.e. 37,000 enterprises - and 28% of their employees - 3.7 million workers, noting that, as already acknowledged above, these are likely to be underestimates (see also Flachenecker et al. 2021b). Overall, the biggest proportions are in “transportation and storage” (9% of HGEs), “food and beverages” (7%) and “accommodation” and “employment activities” (2.5% each). The others, “advertising and market research” (1%) and “travel agency” (0.4%), are not so relevant. In employment terms, “employment services” (12%) leads followed by “transportation” (8.5%) and “food and beverages” (4%).

There are large differences between Member States. In terms of numbers, Austria, the Netherlands and Lithuania are the countries most exposed, followed by Slovenia, Malta and Germany with Luxembourg, Denmark and Poland at the other end of the spectrum. In terms of employment, the spread is even more polarized due to the high share of HGE employees in employment activities. The Netherlands leads with 50% of HGEs employees in sectors at risk (38% in employment activities), followed by Belgium (49%), Italy (37%) and Austria (36%). The countries with the lowest shares are Luxembourg (12%), Bulgaria (14%) and Romania (14%). A particular case is Italy, where the share of HGEs in the employment activities sector is the lowest in the EU, but accounts for one of the largest HGE employment shares in Covid-19 risk related sectors out of the total employment in HGEs. However, comparing countries is not straightforward as it also needs to take into account cross-country differences in COVID policies and their outcomes. Figure 3 shows the regional distribution of the number of HGEs in risk-sectors as a proportion of all HGEs for 2017, where data availability allows it. Such a figure does not convey any time dependent information and so it is important to bear in mind that the episodic nature of high growth at individual firm level means that the picture could change with time. It is not clear how common or rare it is for individual firms to have recurring high growth episodes.
Nonetheless, based on this snapshot, the territorial distribution of the share of HGEs in risk sectors is heterogeneous across the EU regions. At first glance, coastal and Alpine locations seem to have higher shares of “at risk” HGEs, probably due to tourism. For coastal regions, this is the case of Algarve (PT), Andalusia and islands (ES), Sardinia, Sicily, Tuscany, Liguria, Lazio and, more generally, the southern coast (IT), the French Riviera (FR) and coast of Croatia (HR). For the Alps, the regions that present the higher share of HGEs at risk, particularly in accommodation and food and beverages, are Liezen (54%), Pinzgau-Pongau (40%), Außerfern (54%) and Tiroler Oberland (47%) in Austria, Bolzano (37%) in Italy and Savoie (32%) and Haute Alpes (26%) in France.

Other observations:

- The Baltics show high concentrations. In Lithuania (to a lesser extent in Latvia and Estonia) the average presence of HGEs at risk is around 28%. This is mainly due to the transportation sector, consistent with the region’s key role as a transportation hub connecting northern Europe with the rest of the continent (TEN-T Core Network Corridors).
- Many Romanian high-growth enterprises show their presence in COVID-19 risk-related sectors, mainly due to transportation and in regions adjacent to an important transportation corridor: Bihor (37%), Suceava (41%), Constanta (42%) and Giurgiu (47%).

Note: For regional data (Eurostat, 2017), 1468 NUTS3 EU regions: 958 with partial data (only one sector represented) or no data available, 510 with complete data. The regions without data and with partial data have been excluded, since they would have distorted results and the visualization in question. Relevant EU countries excluded: Germany, Greece, Belgium, Netherlands, Denmark, and Sweden. The sectors available and displayed are “transportation”, “accommodation” and “food and beverage”
Italy being the country with the highest overall presence (mainly due to transportation and tourism) accounts for 19 of the top 50 most at risk-regions. Most are above 30% of total HGEs and are located in the south or islands.

Crisis impact on start-ups\(^{15}\) and their employment implications\(^{16}\)

This section provides results of analyses of start-ups using a newly developed EU start-up calculator - a simulator that allows to assess the disruptive impact of COVID-19 on start-up activity and ultimately aggregate employment in the European Union Member States.

At its source, the pipeline of high-growth and indeed all entrepreneurial activity driving economic renewal and growth depends on a high level of innovative and vibrant start-up activity. From the start-up phase, enterprises that survive and thrive move through various stages of development, some increasing in size, occasionally in high-growth spurts, to eventually become significant contributors to the economy. Hence, it is worrying to note a sharp decline in the numbers of new business registrations in the first months of 2020 compared to the same months of previous years across several EU countries (even if, as the year wore on, there were signs of a significant rebound surge responding to new needs and due to laid-off workers launching their own businesses). Figure 4 reports how the number of new companies created declined in the first and second quarters of 2020 with respect to the first and second quarter of 2019. Particularly large drops occurred in Bulgaria (−20.57\% in Q1 and −39.55\% in Q2), Denmark (−49.61\% in Q1 and −54.36\% in Q2), Romania (−35.46\% in Q1 and −38.95\% in Q2), Portugal (−23.94\% in Q1 and −46.07\%) and Spain (−13.94\% in Q1 and −48.04\% in Q2).

Figure 4. Quarter-on-quarter [2020/2019] change in the number of new companies registered in the first and second quarter of 2020 with respect to corresponding quarter for 2019 (percentage).

Note (1): The data, which come from national statistical offices or enterprise registers (in available Member States), are not harmonized across countries. As a consequence, the Figure does not allow quantitative cross-country comparisons\(^{17}\)

\(^{15}\) Start-ups, in this section, are considered to be newly created enterprises or enterprises in the first year of their existence – i.e. aged zero. Young enterprises are less than six years old from when they registered as new businesses.

\(^{16}\) Adapted directly from (Benedetti Fasil et al., 2020a) which discusses Austria, Belgium, Germany, Hungary, Italy and Spain, (Benedetti Fasil et al., 2020c) which discusses Denmark, Estonia, Finland, France, Latvia, Lithuania, Portugal and Sweden and (Benedetti Fasil et al., 2020b) which discusses Bulgaria, Croatia, Czechia, Luxemburg, Netherlands, Poland, Romania, Slovakia and Slovenia. You can find the calculator at: https://ec.europa.eu/jrc/en/covid-19-start-up-calculator

\(^{17}\) Source: JRC, data from Statistics Belgium (STABEL), the Bulgarian National Statistical Institute, the Danish Statistical Institute (DST), Statistics Estonia (SE), Statistics Finland (SF), the National Institute of Statistics and Economic Studies (Insee), the Federal Statistical Office of Germany providing preliminary data (DESTATIS), the Hungarian Central Statistical Office (KSH), the Italian Association of the Chamber of Commerce (IC), the Enterprise Register of Latvia (https://www.ur.gov.lv/en/statistics/), Statistics Lithuania (https://www.stat.gov.lt), Netherlands StatLine (CBS), the Portuguese National Statistical Institute (INE), the Romanian National Trade Statistical Office (ONRC), the Slovak statistical office (https://www.statistics.sk), the business register of Slovenia, the Spanish National Statistical Institute (INE) and the Swedish Registration Offices of Companies (Bolagsverket).
What is more, these data hide large monthly drops in the number of new start-ups registered during the COVID-19 lockdowns. For instance, at the height of the first wave in Spain the number of start-ups dropped by 73.4%, in Bulgaria by more than 65%, in Italy by about 79%, in France by 48.7%, in Romania by 81%, in Portugal by 70.9% and in Slovenia by about 78%, in April 2020 compared to April 2019. The COVID-19 crisis is also likely to affect negatively the survival rate and the growth potential of start-ups for which data are not yet available. Fearful of the medium-term negative impacts on the wider economy, there are many calls for a range of measures specifically aimed at preventing the new enterprise pipeline from slowing down to a trickle (see Mason (2020)).

In the following, we provide selective results based on a string of papers by Benedetti Fasil et al., (2020b, 2020d, 2020c). These papers develop the idea of a start-up calculator which can be used to make scenario-based quantitative projections of how the decline in job creation potential due to the missing generation of start-ups could have a dramatic and lasting effect on aggregate employment that persists as the cohorts of new enterprises mature (see also Gourio et al (2016) and Sedlacek (2020)).

In this analysis, start-ups are those of age 0 and young enterprises are those up to 5 years old. 35% of EU27 enterprises are less than five years old and account for 12% of total EU employment, with start-ups accounting for 2.5%. (Figure 5). In the EU 27 young enterprises account for 35% of employment growth in the period 2013-2017. This pattern is qualitatively present also in the other European countries analysed which show a contribution of young enterprises to employment growth ranging between 2.62% (Luxemburg) to 53.42% (Poland).

![Graph showing share of young firms and employment share of start-ups](image)

**Figure 5. Importance of start-ups and young enterprises for aggregate employment.**

Note(1): The time series for the EU27, Bulgaria, Croatia, Denmark, Finland, Poland and Slovakia is between 2012 and 2017, for Austria, Belgium, Czechia, Estonia, France, Latvia, Luxemburg, Hungary, Italy, Netherlands, Portugal, Romania, Slovenia and Spain between 2008 and 2017, for Lithuania from 2009 to 2017. The Business Demography dataset for Germany and Sweden does not have enough data to compute the start-up and young enterprise contribution to growth. Hence, this is omitted in the Figure. For the other statistics the time series is between 2012 and 2017. Source: JRC, Eurostat, Business Demography dataset, 2020

Importantly, start-ups are also pivotal for the *creation* of new jobs.

Figure 6 shows net job creation (i.e. creation minus destruction) by enterprise age, in the same set of countries. Job creation by start-ups accounts for 0.8-4.6% of aggregate employment. Thus, a lack of start-up activity can lead to an important loss of aggregate employment. The figure also suggests that there is substantial variation across countries in the importance of start-ups for job creation, although qualitatively the patterns are similar.

Acknowledging that challenging times may spark radical innovations (e.g. teleworking, contact-tracing applications) and the creation of new successful enterprises, the COVID-19 crisis is likely to affect negatively not only the rate at which new enterprises are created but also the survival rate of young enterprises. In general, data show that start-ups and young enterprises have a much higher exit rate than older enterprises. Figure 7 shows the evolution of the average survival rate of start-ups during the first five years of activity. In particular, in the EU 27 about 20% of start-ups exit the market during their first year of activity, 43% within three years and only about half survive for five
years. Survival rates also vary considerably across countries\textsuperscript{18}. For instance, in Lithuania about 40% of start-ups exit during their first year while only one quarter of them survive longer than five years. This numbers are in sharp contrast with Sweden, which among the country sampled, shows the highest survival rates. In fact, about only 4% of start-ups exit the market during their first year and only 40% exit during the first five years of activity. Hence, start-ups and young enterprises are more fragile than established incumbents exhibiting higher exit rates. This fragility is exacerbated during recessions – see (Haltiwanger et al., 2013). An economic consequence of COVID-19 is expected to be a higher exit rate of young enterprises, lower enterprise survival rate and, thus, more job destruction.

Finally, the growth potential (i.e. the ability to scale up) of start-ups entering the economy in 2020 is expected to decline as the growth potential of enterprises is linked to the business cycle. During business cycles job creation by start-ups and aggregate employment growth co-move and drop during recessions with a correlation between entrants employment and aggregate employment growth (GDP growth) of 0.36 (0.45). Hence, enterprises that are born during a recession are in general smaller and tend to stay smaller during their life-cycle as shown by (Sedláček & Sterk, 2017). This means that companies like Airbnb, born during a previous crisis, are exceptions to this rule.

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{image1.png}
\caption{Importance of start-ups for job creation. Source: JRC, Eurostat, Business Demography dataset, 2020.}
\end{figure}

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{image2.png}
\caption{Year-on-year survival rate of start-ups Source: JRC, Eurostat, Business Demography dataset, 2020. Note (1): The Eurostat database provides the year-to-year survival rates for start-ups after one, two, three, four and five years of activities. The plotted percentages are the averages of the period from 2013 to 2017 for the EU 27 and Croatia, from 2008 to 2017 for Estonia, France, Latvia, from 2008 to 2018 for Austria, Belgium, Bulgaria, Czechia, Finland, France, Germany, Hungary, Italy, Lithuania, Luxembug, Netherlands, Poland, Portugal, Romania, Slovakia, Slovenia, Spain and Sweden and from 2009 to 2017 for Denmark.}
\end{figure}

\textsuperscript{18} This may be linked to the ease of incorporating a start-up across different countries (e.g. due to regulatory requirements). Given the high rate at which new firms close, countries where it is relatively easy to start, or where there is specific support to enable start-ups, might also be expected to have a low survival rate.
To assess the impact that the disruption of start-ups and young enterprises may have on aggregate employment we developed the “EU start-up calculator”. This simulator permits estimations of the medium-term impact, i.e. up to 2030 of COVID-19 on aggregate employment in individual countries. Different scenarios can be created by varying three parameters: (i) the number of start-ups, (ii) the survival rate of young enterprises and (iii) the growth potential of start-ups. The start-up calculator uses publicly available data from Eurostat allowing analysis of the whole economy as well as the industrial and service sectors in each Member State. Figure 8 shows the scenario assumptions on the three margins (bottom panel), the shock on the three margins (middle panel) as well as the implications for aggregate employment produced by the calculator (top panel). Moreover, the start-up calculator allows also to adjust the simulations taking into consideration general equilibrium effects (red line), i.e. potential employment reallocation towards surviving and older enterprises, which are driven by a lower wage rate caused by the decline in start-up employment.\(^\text{19}\)

At this point of the COVID-19 pandemic it is not clear whether the current economic crisis will be short lived or sustained over a long period. Figure 8 shows the impact for Italy of a shock to the three margins equivalent to the minimum value registered in the time series, i.e. a strong but brief contraction with start-up activities assumed to drop for only one year\(^\text{20}\) to a level corresponding to that experienced during the Great Recession of 2008-2009. For 2020 it reduces aggregate employment by just over 1.4%. The negative trend persists during 2021 during which the reduction in aggregate employment exceed 1.5%. The recovery is very slow: by 2027, aggregate employment is still more than 0.5% below the level it would have attained without the disruption of the activity of start-ups. The cumulative employment loss up to 2030 is 1,186,000. Accounting for equilibrium adjustments, aggregate effects are dampened by 29%, leaving a cumulative employment loss of about 847,000. The decline in the survival rate accounts for about 43% of the effects. The number of start-ups accounts for about 28% and the growth potential for roughly 33% each.

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\(^{19}\) For the details on the methodology, see (Benedetti Fasil et al., 2020c)

\(^{20}\) Dinlersoz et al. (2021) show that new business applications differ markedly during the Great Recession and the COVID-19 pandemic.

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Figure 8. Scenario analysis for employment and the three margins of start-up activity – Italy.

Source: EU start-up calculator, Italy, 2020. Note (1): The simulation on aggregate employment considers a shock on the three margins equal to their sample minima and of one year duration. Enterprises older than 15 are unaffected by the three margins and their time-path does not quantitatively affect the analysis. The blue line represents the impact on aggregate employment taking into account general equilibrium effects.
The EU start-up calculator also allows simulation of bounce-back scenarios to capture the case in which the three margin would recover strongly, i.e. above the 2012-2017 average, from 2021, for instance due to a policy intervention. Figure 9 shows the case in which the subdued enterprise entry in 2020 due to the COVID-19 crisis may be the result of a pent-up supply with more enterprise entry in 2021. After the initial negative shock, the number of start-ups is increased in 2021 to the maximum level registered in the time series. After an initial sharp decline in aggregate employment, the increased number of start-ups entering in 2021 causes a significant improvement of the employment trend and a lower cumulative job loss totaling to about 729,000. Despite the better outlook the recovery is still sluggish and aggregate employment still does not reach its pre COVID-19 level by 2030.

![Figure 9. Bounce-back scenario in the number of enterprises, results for aggregate employment – Italy. Source: EU start-up calculator, Italy, 2020. Note (1): The simulation on aggregate employment considers a shock on the three margins equal to their sample minima and of one year duration. The bounce-back in the number of start-ups is assumed to take place in 2021, to be equal to the sample maxima and last one year. Enterprises older than 15 are unaffected by the three margins and their time-path does not quantitatively affect the analysis. The blue line represents the impact on aggregate employment taking into account general equilibrium effects.](image)

Analyses provided by the EU start-up calculator are available for Austria, Belgium, Germany, Hungary, Italy and Spain in (Benedetti Fasil et al., 2020a), for Denmark, Estonia, Finland, France, Latvia, Lithuania, Portugal and Sweden in (Benedetti Fasil et al., 2020b) and for Bulgaria, Croatia, Czechia, Luxemburg, Netherlands, Poland, Romania, Slovenia and Slovakia in (Benedetti Fasil et al., 2020c). Unfortunately data unavailability has prevented similar analysis for Cyprus, Greece, Ireland and Malta. Moreover, an online web tool that allows users to simulate in real time different scenarios is available on the JRC’s Science Hub.21

A strong but short-lived crisis would create substantial and persistent aggregate employment losses, especially in all countries ranging between -0.25 (Luxemburg) to -6.9% (Slovakia) in 2020 and adds to a cumulative employment loss for the period 2020-2030 ranging from 5,600 (Luxemburg) to 2,179,000 (Poland). The potential negative impact is particularly high in Austria, Bulgaria, Croatia, Estonia, France, Latvia, Lithuania, Hungary, Italy, Poland, Portugal, Romania, Slovakia and Spain, as well as in the services sector, which are characterized by a high enterprise turnover and a reliance on start-ups and young enterprises for job creation. We also find that in most countries the

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deterioration of the survival rate of young enterprises plays an important role in driving employment, seconded by the number of new entrants.

The medium-term effect on aggregate employment may be significantly mitigated by policies aimed at supporting young enterprises and incentivizing the creation of new ones. This represents a positive factor as this group of enterprises, i.e. start-ups, is easily identifiable by policy makers and hence represents an easy target for policy interventions. In fact, when we simulate bounce-back scenarios where the number of enterprises entering the economy rapidly increases in 2021, in every country the outlook is significantly improved, the recovery is faster and the aggregate job loss is lower. Likewise, policies aimed at increasing the survival rate of young enterprises would also be quite effective in mitigating the negative impact of the crisis. These results suggest that policy makers have ample space for maneuver for policy specifically targeting start-up and young enterprises (see also chapter 8 for a short overview of the national policy response to the COVID-19 pandemic). Other policy aims may consider increasing the potential pipeline of HGEs by increasing the overall start-up rate, and supporting entrepreneurs of failed start-ups to help them start another company.

The key findings of this chapter are as follows:

- The COVID-19 crisis has uneven effects across the business economy. Six economic sectors are particularly hit
- The share of HGEs in more than 60% of these sectors is higher than the EU average for the business economy as a whole. This may indicate the possibility that the pandemic weakens a number of high-growth ecosystems
- At the EU level, the main at-risk sectors represent 22% of HGEs and 28% of employees hired by HGEs. Among MS there are significant differences in these shares. However, comparing countries is not straightforward because of differences in the national policy response to the COVID-19 pandemic and their outcomes
- Disruptions of start-up enterprises might cause significant negative employment effects in the long-run. Simulations show that a strong, but short-lived crisis could generate important and persistent job losses across EU Member States: The negative impact is particularly high in the service sector.
Chapter 4 Lessons from the Great Recession

The economic aspects of the COVID-19 crisis are unprecedented in scale, speed and the number of channels through which activities are impacted (Baldwin & Weder di Mauro, 2020). Nonetheless, analysis of the role played by HGEs before, during and after the Great Recession of 2007-2009, as presented in this chapter, may provide useful insights for the current COVID-19 crisis.

Previous studies that have focused on the growth dynamics of enterprises in crisis times provided mixed results. For example, Criscuolo et al. (2014) shed light on the role of young SMEs during the Great Recession. This particular subset of firms heavily counteract job destruction during the downturn, with large cross-country differences related to variability in growth potential. In contrast, for the manufacturing and hospitality sectors, Peric & Vitezic (2016) suggest that during crises, turnover growth is positively associated with company size, with large and medium-sized enterprises, exhibiting higher growth rates. Moscarini & Postel-Vinay (2012) on the other hand, provide evidence that large firms are more sensitive to business cycles, firing more employees during crises, but recovering more jobs in the subsequent economic upswing.

While HGEs by definition support economic growth, the size of their aggregate contribution depends on the combined distribution of firm size and firm growth (Flachenecker et al., 2020). This is likely to be country and context specific and hence sensitive to recessions with heterogeneous effects across countries. The Great Recession provides an interesting case to study the contribution of HGE to economic activity before, during and after a crisis. The aim of this chapter is to analyse how the population of HGEs behave during the period 2006-2014, particularly in relation to their share and contribution to aggregate sales growth.

To this end, the results reported below are based on work which broadly followed the OECD/EU definition of HGEs as enterprises which experienced an average annualised growth sales of more than 10%, 15% or 20% over a two-year period with at least 10 employees at the beginning of the growth period. First, we characterise the EU population of HGEs before, during and after the Great Recession. Second, we highlight the co-evolution of firm size and growth and calculate the contribution to aggregate annual sales growth before, during and after the Great Recession. Third, we document the link between sales and GDP using national accounts data. The present work is based on Flachenecker et al. (2021b).

Main findings

- The share of HGEs in overall sales growth suffers disproportionately during downturns. Irrespective of the macroeconomic situation, HGEs are predominantly small-to-mid-sized, mirroring the overall distribution of enterprises. However, smaller-sized firms are overrepresented in the HGE distribution. A recession curbs firm growth across the board, reducing the overall share of HGEs sharply. Importantly however, the larger the enterprise, the heavier the recession weighs on its sales growth, both in absolute and relative terms.

- HGEs, especially larger ones, boost activity considerably even during crises: Despite being hit disproportionally during crises (reducing their relative importance for aggregate sales growth), HGEs still contribute considerably to economic activity. Importantly, the economic significance of HGEs (for short-run growth) is almost entirely based on large HGEs, both in expansions but even more so during the recovery phases.

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22 Adapted directly from Flachenecker et al. (2021b).
23 Furthermore, the impact of the COVID-19 crisis on sectoral economic activity varies significantly (see also Chapter 3) and differs markedly compared to normal recessions (European Commission, 2021b).
24 The definition mirrors the one used by Eurostat, but using two years, instead of three, as a time reference, because of how the survey was conducted.
Data and methodology

Our main source is firm-level data from the biennial Community Innovation Survey (CIS), covering the 10-year window around the Great Recession. We use results from the 2004-2006, 2006-2008, 2008-2010, 2010-2012 and 2012-2014 editions. The surveys cover firms with 10+ employees operating in the business economy of 16 EU Member States.

The survey design only allows construction of an unbalanced pooled cross-section and not a panel. This limits the possibility to follow individual HGEs over time, and requires us to analyse the HGE distributions across each biennial wave. The combined dataset comprises over 500,000 observations, representing 2.3 million EU enterprises (stratified sampling), and roughly 433,000 enterprises per wave.

In terms of methods, we predominantly apply statistical means to compare the HGE distributions over time and across countries. We further apply distributional analyses across firm sizes and firm growth rates to assess their relative contributions to overall economic growth (in terms of sales growth).

HGEs before, during and after the Great Recession

Figure 10 shows EU growth over the past two decades and highlights our case study period – i.e. years before, during (including the double-dip recession of 2009 and 2012) and after the Great Recession.

Figure 10. Year-on-year growth rates of GDP in the EU between 2000 and 2019
Source: Eurostat. The years represented with a bold line are covered by the analysis.

Figure 11 plots the evolution of the share of HGEs above different sales growth thresholds. Note that HGEs represent a small but significant share of the overall sample of enterprises, ranging between 30% in 2005-2006 to about 10% in 2009-2010 for the stricter 20% annual growth criterion. This is broadly in line with findings in Flachenecker, Gavigan, et al. (2020). Figure 11 also shows the co-movement between the share of HGEs across different definitions and EU27 GDP growth.
This pattern for HGEs is symptomatic of a broad-based drop in firm growth (Figure 12). The recession reduced firm growth across the board, and narrowed the growth rate variation across firms, becoming particularly visible in 2012 and 2014. In line with our previous findings in Figure 11, firms at the top of sales distribution drop sharply in 2010 and only partially recover thereafter.

Figure 13 plots estimates for the probability (based on median values and their confidence intervals) of an enterprise being a HGE (vertical axis) according to its size (horizontal axis; in log sales). This analysis is particularly relevant to better understand two issues:

- **HGE demographics**: Smaller firms of around € 60,000 annual sales have a roughly 40% higher probability during normal times of becoming HGEs compared to firms with € 400 million sales. This confirms previous findings that most HGEs are small or medium-sized enterprises.

- **HGE demographics and the Great Recession**: Figure 13 also shows how the Great Recession affects the distribution of HGEs across different size classes. The discrepancy between smaller and larger enterprises of the likelihood of being a HGE intensifies during the recession. While the crisis reduced HGE probabilities across the board, it affected large firms disproportionally. Even during the mild recovery in 2011–2012, the chances for medium or large enterprises to become a HGE were only one to two fifths of the likelihood of being a HGE during 2005–2006.
The contribution of HGEs to economic recovery

While HGEs are known to be engines of growth during normal times, we know relatively little about their role during crises or recoveries. We apply a straightforward definition of aggregate relevance:

\[
\omega_{\text{sales}} = \frac{\text{additional sales of HGEs}}{\text{additional aggregate sales}}
\]

Importantly, the relevance of HGEs for aggregated economic activity will depend on how the numerator and denominator evolve over the cycle – both of which depend on the joint distribution of firm size and firm growth. We therefore assess the share of aggregate firm sales growth that can be attributed to HGEs. Figure 14 plots \( \omega_{\text{sales}} \) and \( 1 - \omega_{\text{sales}} \) for each survey wave. While HGEs accounted for almost two thirds of sales growth prior to the crisis (while accounting for only around 30% of all enterprises), the share practically reversed for the years 2009-2010. Subsequently, the shares approached pre-crisis levels before falling back again. What becomes apparent is that the contribution of HGEs to macroeconomic activity is significantly reduced during the crisis, but rebalanced during the first upswing of the double dip recession, before being hit yet again.

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25 A couple of examples of studies referring to HGEs and recessions (generally stating the positive contribution to employment growth) can be found in Henrekson & Johansson (2010).

26 To not artificially over-state the role of HGEs, we restrict our attention to enterprises with positive sales growth. Note that all sales growth will to some extent induce sales reductions for direct or indirect competitors. Whether HGEs’ sales growth disproportionately capitalise on capturing market share will be subject to subsequent analysis. If so, the analysis of this section would overstates the economic benefit of HGEs.
Given that also small changes for a subset of large firms can affect aggregate contributions so profoundly, we further decompose $\omega_{\text{sales}}$ by firm size in Figure 15. Specifically, we split the sample into "larger" and "smaller" firms along the period-specific median\(^{27}\). The findings suggest that in all periods, above-median-sized firms account for 80–90% of (gross) aggregate sales growth. Put differently, it does not seem to be the distinction between HGE and non-HGE that matters, but the distinction between large and small enterprises for the contribution to macroeconomic activity. Note that this finding is not straightforward since we observed that large enterprises tend to grow systematically slower. Despite that, they prevail in aggregate sales growth contribution. Figure 15 also shows that the 2008 to 2014 dynamics in HGE versus non-HGE sales shares are purely driven by large HGEs. In fact, the share of small HGEs even moves in the opposite direction.

These findings are even more striking when comparing the sales shares with the subpopulation sizes. Figure 15 shows the sample population share for each category. Overall, the 29–60% sales weight of large HGEs appears even more remarkable in light of a population share of 2–8%. All the above mentioned results are robust when excluding firms that had mergers or acquisitions in the previous years and therefore reflect organic firm growth.

\(^{27}\) The median is pretty stable over time and approximately EUR 1 million of sales in all years.
In summary, the general pattern seems to be that HGEs reduce their importance during downswings, but still account for a lion’s share of sales growth, despite their relatively small number. Especially, the large HGEs can make the difference, in particular during the recovery, as they appear to drive the increase in macroeconomic activity during this crucial phase. They account for more than 30% of aggregated sales growth, only being 2% of the number of enterprises.

We do not observe value added at the enterprise level, nor does the survey provide sufficient data for manual computation. Thus, we rely on (gross) sales to trace dynamics and compute the contributions to aggregate growth, as shown in the previous paragraphs. This link is especially important for policy makers since increasing gross sales per se is not necessarily a policy objective, but value added and GDP growth are, being more comprehensive. Therefore, in Flachenecker et al. (2021b), we also complement the CIS data analysed above with national accounts data, finding a strong correlation between sector-level sales growth computed from the CIS and sector level value added figures extracted from the national accounts. Nevertheless, sales growth appears to be a useful predictor for growth in value added.

**Discussion and conclusions**

When interpreting our results, the following caveats should be kept in mind:

- Due to lack of data, we are not able to analyse the full recovery phase. The most recent CIS wave 2014-2016 will hopefully be released by the end of 2020.
- Though devastating, the Great Recession was still milder than what is expected of the economic...
crisis induced by the COVID-19 pandemic. In addition, the actual crisis is different under different characteristics (causes, scope, measures adopted etc.). Our results should thus be projected cautiously onto the current situation.

- The sample composition of countries changes across years, which might affect results in various ways. Fortunately, the sample is largely stable for the critical last three periods.
- We do not have access to panel data. Therefore, it is important to interpret the findings as changes in the distribution of HGEs, but not as impacts on individual HGEs.

Nevertheless, few important conclusions can serve as a useful background for discussion among policy-makers: (i) Recessions reduce firm growth across all size classes; (ii) HGEs continue to be important contributors to economic activity, also during phases of economic crises; (iii) Large HGEs are most important during the immediate recovery phase (notwithstanding the importance of small HGEs for innovative capacity and long run growth potential).

In conclusion, it can be useful, again in a policy perspective, to understand more granularly this particular subset of enterprises. By zooming into those large HGEs that dragged the recovery process, we found several interesting insights that characterise those enterprises. Less than one in twenty enterprises in the sample is a large (above median size) HGE. Those are more innovative and likely to be part of an enterprise group. Moreover, they show a larger share of exporters and lower presence of enterprises serving only their regional markets. Sector-wise, large HGEs are significantly more frequent in air transport, manufacture of electrical equipment, manufacture of machinery and equipment, civil engineering (civil constructions), insurance and manufacture of motor vehicles. Regarding the role of public policy instruments: even though a higher number of large HGEs tend to receive public funding (dedicated to innovation) compared to other categories, this result is not significant when including baseline controls. The same applies to public procurement, patenting activities and obstacles to innovation.

It would be interesting to understand more specifically this particular subset of enterprises. Future research could focus on what specific type of large HGEs are behind these processes or the role of public policy in shaping those particular dynamics. For any policy insight that can be distilled from the present work (see Flachenecker et al. (2021b), it is necessary to state that, even if focusing policy support to large enterprises might be useful in the short term during a recovery process, this kind of support needs to be carefully designed to minimise the risks of lowering levels of competition and innovation dynamism in the medium to long-term.
This chapter provides evidence of the effects of environmental innovations on firm growth. It builds on debates among scholars and policymakers about a potential trade-off between economic and environmental objectives and the role of public policy in steering the transition to sustainable development (Arrow et al., 1995; Jaffe et al., 1996; Porter & Linde, 1995). This is pertinent to the EU recovery strategies in the context of the COVID-19 crisis, in line with the recent European Green Deal, aiming for a recovery combining both economic and environmental objectives (European Commission, 2020d, 2020f).

Innovation is generally seen to enable the above-mentioned objectives (Giovannini et al., 2015). In this sense, a specific type that explicitly combines economic and environmental aspects are environmental innovations, also referred to as eco-innovations (Kemp et al., 2019). However, evidence on the economic outcomes of public financial support for environmental innovations is sparse (Cainelli et al., 2020; Flachenecker & Kornejew, 2019; Ghisetti, 2017; Ghisetti & Pontoni, 2015). Further research is particularly important in the EU context, in view of its relevance to several political priorities of the European Commission, including not only the European Green Deal, but also the SME Strategy and the recovery plan from the COVID-19 pandemic (European Commission, 2019, 2020a, 2020d).

Spurring firm growth through the beneficial effects of environmental innovations can potentially lead to the emergence of new high-growth enterprises in the EU context in the upcoming years. There is already positive evidence of the positive effect of environmental innovation for firm growth in the EU (see for e.g. Jové-Llopis & Segarra-Blasco (2018)). It is nevertheless important to shed more light, through different and deeper statistical analyses, on this yet largely unexplored relationship. The following paragraphs will present the dataset, the methods employed and introduce some of the results from Flachenecker et al. (2021a), and concludes with a policy-based discussion.

**Data, descriptive statistics and channels of impact**

The analysis is based on data from the European Commission’s Community Innovation Survey (CIS) for 13 EU Member States from 2012 to 2014. According to the CIS, one quarter of enterprises generated an environmental innovation between 2012 and 2014, 18% reported that they environmentally innovated due to public financial support, of which 2% mentioned that public financial support was highly important in realising the environmental innovation.

![Figure 16. Enterprise share of environmental innovations adoption and relevant public financial support (PFS) received for environmental innovation by country. Weighted mean. PFS stands for public financial support. Source: CIS 2014](image1)

![Figure 17. Enterprise share of environmental innovations adoption and relevant public financial support (PFS) received for environmental innovation by NACE code (sector). Weighted mean. PFS stands for public financial support. Source: CIS 2014](image2)

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28 Adapted directly from Flachenecker et al., (2021a).
29 Eco-innovations (or environmental innovations) are product, process, organizational or marketing innovations that improve environmental performances (contributing to sustainable development).
31 Share of enterprises having adopted at least one kind of eco-innovation during the period 2012-2014 and share of
Figure 16 and Figure 17 show that there are large differences across countries and sectors - from Germany with 34% of enterprises environmentally innovating to Romania with 3%, from manufacturing with 31% of enterprises having realised an environmental innovation to real estate with 9%. Interestingly, the distribution for relevant public financial support (at firm level) does not correlate highly with the share of enterprises that introduced an environmental innovation. This suggests that the prevalence of environmental innovations in a given country or sector may be explained by other factors such as market demand, technological advancements and firm characteristics (see for example García-Quevedo et al. (2020)).

Figure 18 and Figure 19 also show large country and sector differences in employment and turnover growth among the firms from the whole sample. The average enterprise grew by 11% in terms of employment between 2012 and 2014, especially in Latvia, Lithuania and Bulgaria as well as in real estate and accommodation/food services. Turnover growth is highly correlated with growth in employment, which shows a similarly high-level heterogeneity (note the particularly high growth for accommodation/food services).

The association between these two variables is far from simple, especially considering the vast literature behind the association between environmental innovations and firm performances, tracing back to the Porter hypothesis\(^{32}\) (Porter & Linde, 1995). Figure 20 illustrates the various channels through which environmental innovations (in product, process, organisational or marketing forms) can affect employment and revenues. To put it simply, the key issue is to assess whether the costs of environmental innovating activities (direct, indirect, financial, opportunity), in addition to its labour substitution effects (due to a decreasing cost of capital), could be offset by the gains associated with the environmental innovation. These can be related to an environmentally innovative product (new demand reached, CSR gains), but also to an environmentally innovative process (productivity increase, cost reduction), lead to firm’s subsequent growth (continuous innovations), and reduce environmental pressures (reduced environmental externalities).

\(^{32}\) The Porter hypothesis reaffirms the benefits of environmental policies, stating that well-designed and strict environmental regulation can incentivise innovations, increasing firm’s productivity and its results.

enterprises considering of high “importance” to public grants, subsidies or other financial incentives for eco-innovation for the decision to eco-innovate in 2012-2014 (out of total enterprises).
Results of the analysis

The analysis conducted by Flachenecker et al. (2021a) is based on an innovative (relative to the topic) empirical strategy, following the methods of Flachenecker & Kornejew (2019). The modelling approach consists of applying an instrumental variable estimation by employing public financial support for environmental innovation as the instrument. This is described in detail in Flachenecker et al. (2021a) along with several data and methodology related limitations. It is important to interpret the following results in the spirit of the local average treatment effect (LATE)33 (Angrist et al., 1996; Imbens & Angrist, 1994). In this regard, it is essentially evaluated whether public support received for environmental innovations result in firm growth, including different perspectives on firm growth – turnover, employment and market share growth, and the emergence of high growth enterprises (HGEs).

The analysis carried out shows that publicly supported environmental innovations can significantly and substantially increase not only the employment of enterprises, but also their turnover and market shares. This suggests that public financial support can align economic with environmental objectives and overcome the ‘double externality’ constraint. Public intervention, in fact, is needed to tackle two types of market inefficiencies, the under-provision of funds for innovation, due to fast-imitation and high adoption rates, and the non-priced cost of environmental harm. By supporting environmental innovations that would have not been effectively pushed left alone to market forces, firms could have higher chance to grow both their revenues and employment.

Concerning HGEs, the adoption of public supported environmental innovation increases also the likelihood to become HGEs in terms of turnover, but this one decreases for more stringent growth definitions of HGEs. Hence, not only these types of innovations may spur further firm’s growth, but can also influence the emergence of the particular category of enterprises investigated in the report. This is in line with what empirically found by (Colombelli et al., 2019) which using firm-level data coupled with patent information, show that environmental innovations are likely to increase the

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33 The LATE theorem says that (under the assumptions) instrumental variable estimates the average causal effect of treatment on the subpopulation of compliers. LATE stands for Local average treatment effect: the average is not for all treated, but for an instrument specific subpopulation.
effects of innovation on firms’ sales growth, particularly for gazelles.

With an eye on the policy implications of such effects, a high variability among HGEs in different countries can be detected. Figure 21 shows that the rate of adoption of environmental innovations among HGEs is higher than among all enterprises considered and clearly spans from very high values in Germany, to lower values in other EU Member States. As concerns public funding, it seems that Greece, Portugal and Croatia stand out in terms of share of HGEs having received relevant public support for environmental innovation, while the others display lower shares despite the different support depth.

![Figure 21. HGEs share of environmental innovations adoption and public financial support (PFS) received for environmental innovation by country.](image)

Weighted mean. PFS stands for public financial support. Source: CIS 2014

**Discussion and conclusions**

When interpreting our results, the following caveats should be kept in mind:

- CIS data date back to the growth period 2012-2014, not covering all 27 EU Member States and all NACE sectors. This prevents us from having a complete snapshot of the EU situation, despite the valid general messages that can be distilled from the present work.

- Environmental innovation related questions in the CIS refers to the adoption of certain types of environmental innovation. However, there are not measures of the relative intensity and sophistication. The same applies for the public support for environmental innovation, generally referred as grants, subsidies and other financial incentives.

- The CIS is not a panel, which limits the analysis to the short term effects of environmental innovations on firm’s results.

The previous literature on the topic is divided among the different policy measures to sustain environmental innovative activities and public support measures; loans and subsidies are either seen as ineffectual (Triguero et al., 2013) or important promoter of green innovation (Cecere et al., 2020). The findings suggest that public financial support can align economic and environmental objectives while incentivising innovation activities for enterprises. Therefore, public policy supporting environmental innovations might facilitate the transition to a more sustainable economy, including as a key component of the recovery process from the COVID-19 crisis.

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34 Share of HGEs having adopted at least one kind of environmental innovation during the period 2012-2014 and share of HGEs considering of low, medium and high “importance” public grants, subsidies or other financial incentives for environmental innovation for the decision to environmentally innovate in 2012-2014 (out of total enterprises)
At the EU level, environmental innovation promotion is part of a broader set of “green” policies which still could benefit from a more coherent, systematic reorganization. The most important action in this sense is the Eco-innovation Action Plan, set in 2011, comprehending a series of initiatives including the Eco-innovation Observatory and Scoreboard, the Network for Eco-innovation Investments (INNEON), European Innovation Partnership etc. Though, the public funding secured by the EU context is still sparse around multiple different funds under the umbrella of different EU programmes, most of those targeting more general behaviours, such as circular economy, SMEs or sustainability (see Figure 22). At the Member State level, instead, environmental innovation is sometimes not even addressed as a specific policy, but included into general innovation or sustainable policies. Public support for R&D related to “green” sectors is highly unequal across member states, according to Eurostat data for 2018.

![Figure 22. Environmental innovation funding.](image)

Sources: Horizon 2020 work programme; Life multiannual work programme; Interim evaluation of COSME program; EU Commission, ESIF, finances; EIB, EFSI Investment by sector

To this end, providing specific public financial support for environmental innovations through grants, subsidies or other financial incentives is consistent with the results of this section.\(^{35}\) The findings can therefore support the design of policy aiming to support the scaling-up of firms, while positively contributing to greater environmental sustainability. These insights could further support the implementation of the objectives of the European Green Deal, the SME Strategy and enabling a sustainable recovery from the COVID-19 pandemic.

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\(^{35}\) Bearing in mind the importance of other types of environmental policies (such as standard setting, pricing pollution or environmental restrictions).
Chapter 6 Digitalization

Digital technologies provide strategic advantage that can lead to the emergence of HGEs (Barret et al., 2016). In this chapter, we provide some statistics on digitalization for HGEs drawing on the EIB Group Survey on Investment and Investment Finance (EIBIS)36 and Flash Eurobarometer 486, 202037. There is an extensive body of literature discussing the importance of digitalization for firm growth as it: i) opens new markets, ii) potentially increases the ability of enterprises to target and communicate with more distant stakeholders, and iii) can rapidly boost productive processes through cost reduction, outsourcing and increasing productivity (see Cathles et al., 2020; Gal et al., 2019) among others. Finally, a growing number of enterprises produce digital products, such as software or digital services, therefore reaching new profitable demand segments.

The main purpose of this chapter is to present an overview of the status of digitalization across various subsets of firms related to growth, namely HGEs, growing firms and firms planning to grow. Specifically, using two different datasets (EIBIS and Flash Eurobarometer 486) we shed light on the use of digital technologies by firms in the EU and the main challenges they face from the transformed digital setting. The empirical findings are presented country by country and comparisons shown with the US and the UK.

Digitalization in the EU: some statistics from the EIBIS and Flash Eurobarometer 486

The indicator on digitalization included in the HGE indicator framework and shown in Figure 23 is the share of HGEs having adopted partially or fully any digital technologies in parts of their business, and is based on the EIBIS survey. This shows that the use of digital technologies by HGEs is different across countries, ranging from 83% of enterprises in Slovakia to 32% in Latvia. In general, HGEs show a considerably larger adoption rate of digital technologies than other enterprises. The overall EU level is 70% and is in line with the US (74%) and the UK (70%).

Elsewhere, a substantial emphasis on digitalization was included in the Flash Eurobarometer 486 survey of SMEs, start-ups, scale-ups and entrepreneurship which was carried out in 2020 for all EU27 countries (12,615 enterprises interviewed) and 12 non-EU countries (3,748 enterprises interviewed) including, UK, USA, Canada, Brazil, Japan, Turkey, Norway and others. In the following, the results of this survey are used to shed light on how HGEs embrace various aspects of digitalization. The analysis gives insights into digitalization characteristics of HGEs.

Figure 23. Share of HGEs that have declared to have adopted partially or fully any digital technology. [Source: EIBIS 2019. In this survey, A digital firm is firm that adopted any digital technology partially or fully. A firm is identified as partially digital if at least one digital technology was implemented in parts of the business: and fully digital if the entire business is organized around at least one digital technology]

Figure 24. Share of "growth firms" respondents that declared that have a strategy or action plan to digitalize
(Source: Eurobarometer486 Q9. In this survey, HGEs are those with at least 30% revenue growth in the last three years; moderate growth enterprises are those having grown by less than 30% in the last three years. "Growth enterprises" refers to the combination of moderate and high-growth enterprises. Other categories in the survey are stable enterprises (turnover growth=0) and decreasing enterprises (turnover growth <0).)

Figure 24 shows that the digitalization of enterprises varies enormously across Member States. Analysing only those enterprises that have experienced growth in the past three years (so-called "growth enterprises") reveals a spread of "digitalized" growth enterprise share from 45% for Belgium to only 1% for Hungary. The EU average of 22% is similar to UK and US values, but with important cross-country differences. Mostly northern and western EU Member States present above average values, while structural deficiencies in Eastern European countries in addition to Italy and Greece give rise to below average values.

Figure 25. Share of enterprise that declared that they plan to grow as a result of increased digitalization
(Source: Eurobarometer486, Q7a. In terms of growth, either in employment or turnover, does your enterprise plan to grow as a result of increased digitalization in your enterprise? Q5: High-growth enterprises are those enterprises planning to grow their revenues by at least 10% on average per year. Moderate growth enterprises are those planning to grow by less than 10% on average per year.)
Figure 25 shows that the share of HGEs enterprises that declared that they plan to grow as a result of increased digitalization, is higher than the share of ‘moderate growth’ enterprises, suggesting that they count more on digitalization as a means for further growth than ‘moderate growth’ enterprises, with the exception of Cyprus and Hungary.

On average, 31% of such aspiring HGEs in the EU plan to grow as a result of increased digitalization – lower than the 41% share for the US and the UK. However, it is important to distinguish between leader, average and laggard Member States – leaders include Germany (54%), Spain (53%), Portugal (52%), Ireland (50%), Belgium (47%) and Denmark (44%); average Member States where the share is between 30-40% include France, the Netherlands and Austria; and laggards include Eastern European Member States, Italy and Greece. The pattern is similar though with lower percentages for enterprises that plan to grow by less than 10% per year. Exceptions to this are Hungary where the share is considerably higher for moderate growth plan enterprises, and the Netherlands where the two shares are equal.

Figure 26. Growth enterprises approach to digital technologies

[Source: Eurobarometer486, Q22: Please indicate which of the following options best describes your enterprise’s approach to digital technologies? (ONE ANSWER ONLY, including “don’t know” and “other”, but in a very small share) By growth enterprises, it is intended both moderate and high-growth turnover enterprises in the sample]

A further disaggregation sheds light on the different approaches growing companies have to digitalization. Figure 26 shows that the share of firms that apply only basic digital technologies is higher in all countries. The EU average, is more or less the same as the US and the UK (slightly less), in terms of the share of growing enterprises that acknowledged the importance of using advanced digital technologies in the productive process and have started to adopt or have already adopted them. However, the share that declared no need for any digital technology is lower than in the US or UK. The variability across Member States shows a similar pattern as above. Some notable observations include:

- Despite performing well overall, Denmark has the highest share of growth enterprises claiming no need for digital technologies.
- Italy has the lowest share of growth enterprises claiming no need for digital technologies, but the largest share of companies that use only basic digital technologies, such as e-mails and websites.
- Lithuania, Hungary, Portugal and Spain, have the largest share of growth enterprises acknowledging the need for advanced digital technologies, but incapable of adopting them.

Finally, the shares EU growth enterprises adopting advanced digital technologies for production processes, are lower in almost all the relevant technology domains compared to the U.S and the U.K. e.g. for: cloud computing (63% vs 65% on average); high-speed infrastructure (36% vs 46%); smart devices (27% vs 36%); big data analytics (14% vs 18%); and artificial intelligence (8.5% vs 9%). Notable exceptions are Sweden, Netherlands, Spain and Ireland for which the shares are similar or higher for almost all the technology domains.

**Discussion and conclusions**

Covid-19 pandemic has accelerated the digital transition. Firms, governments and workers have increased the rate of adoption of digital technology by acquiring new software and hardware and also by training their employees around the world (Kilic and Marin, 2020; Breynjolfsn et al., 2020). Interestingly, the Covid-19 pandemic has brought about a demand-pull effect for the adoption of digital technologies, instead of the traditional technology-push effect. However, the adoption of new digital technologies is a step farther away - it requires different capabilities to just the use of digital technologies for working remotely (see for instance (Urbinati et al., 2020)).

Our descriptive evidence shows that: i) enterprises that declare that they plan to grow in the next few years value more digitalization as their future growth engine compared to those with lower growth expectations; ii) there is a very large difference across countries for different aspects of digitalization; and iii) in the EU performance of growth firms is on average below that in the US and UK, but countries such as Germany, Sweden or Spain display better results for some of the investigated issues compared to other EU countries.
Chapter 7 Financing and venture capital issues

The provision of suitable finance to HGEs requires the presence of effective financial systems that support innovation and growth. According to the latest ECB SAFE Survey (2020), bank finance is by far the main source of finance for most enterprises (small, HGEs, and large companies). When external finance is needed, the majority of HGEs rely on small-scale debt finance: overdrafts and bank loans. Only a small proportion of HGEs headquartered in EU27 countries seeking external finance, 14.5%, avail of venture capital (ECB SAFE Survey, 2020). A natural question is why venture capital is important if only such a small proportion of HGEs use it. The primary reason is that this small proportion of VC-backed firms represents a particularly economically-significant set with a disproportionately higher impact on productivity and employment than non-VC-backed firms (Crisanti et al., 2019; Pavlova & Signore, 2019; Puri & Zarutskie, 2012). Economic literature has established where the importance of VC lies: 1. VCs provide important services in addition to providing finance, such as helping the company to raise more finance, and helping to formulate business strategy (Gompers & Lerner, 2001); 2. VC plays a key role in the innovation process as VC-backed companies bring more radical innovations to market than non-VC backed companies (Hellmann & Puri, 2000; Powell et al., 2002); and 3. It is central to the development of an entrepreneurial ecosystem as it acts a catalyst or technological gatekeeper by facilitating and steering innovation within regional innovation networks (Florida & Kenney, 1988; Saxenian & Sabel, 2008).

In what follows, we look at ways in which HGEs, as defined in the SAFE report (2020), finance their business activities. We then discuss the role of VC and business angels in enabling and accelerating the growth of VC-backed companies. In particular, complementary to emerging literature on the impact of the pandemic on VC (Botsari et al., 2021; Kraemer-Eis et al., 2021; Mason, 2020; PitchBook, 2020), we take a close look at both investment and fundraising activity trends in EU27 countries using quarterly VC data from Dealroom.co up to the end of 2020.

The financing of HGEs: results from the ECB SAFE Survey (2020)

Over the past decade, there has been increasing attention to the skewed nature of firm-size distribution, and to the disproportional impact HGEs have on innovation, employment and productivity growth (McCann et al., 2014; among others). In the area of entrepreneurial finance, the study of potential HGEs has predominately focused on VC-backed companies. While this is of relevance to a specific subset of potential HGEs, it provides little insight into how these companies raise finance at different points in their development. The ECB SAFE Survey (2020) provides some insight into this though it does not provide a dynamic perspective.

According to the results of the latest SAFE survey, the most relevant sources of funding for all types of companies are the traditional bank-related products (bank overdrafts and bank loans) and leasing (Figure 27). HGEs consider all of the listed financing instruments to be more relevant compared to other types of enterprises (both large and SMEs), suggesting that they need to raise funding from a variety of sources of finance (e.g. grants, loans, equity). As can be seen from Figure 27, equity is

38 For many HGEs bank finance is not available, and given that they are outside the risk appetite of banks, VC remains the only other private financing option, as we discussed in Flachenecker et al. (2020).
39 We used the definition of HGEs based on turnover, i.e. those firms who have declared that they have grown on an annualized basis over 20% per year on average in terms of turnover over the past three years.
40 In the economic literature a highly skewed distribution of firm size, and sales suggests that a few large firms coexist with a large number of small firms.
41 See Flachenecker et al. (2020) for a discussion of different definitions of HGEs.
42 In this context, (Masiak et al., 2017, 2019, 2020; Moritz et al., 2015) provide some interesting insights into the financing patterns of SMEs in Europe.
43 The survey is conducted twice a year: once by the ECB covering euro area countries and once in cooperation with the European Commission covering all EU countries plus some neighbouring countries.
44 Please note that Figure 27 and Figure 28 are based on question 4 of the SAFE Survey, which is a two-step question. More precisely, Figure 27 draws on the question if a specific source of financing (bank loan, credit line etc.) is relevant for the respondent, where “relevant” means “Have you used them in the past or considered using them in the future?”. Figure 28 draws on the question, – if the source is relevant – “Have you used in the recent past (last 6 months)?”
relevant for 14.5% of HGEs.

Figure 27 European enterprises’ use of financing.
Data source: Survey on the Access to Finance of Enterprises (SAFE), 2020. Related question: Are the following sources of financing relevant to your enterprise that is, have you used them in the past or considered using them in the future?

Figure 28 shows the use of different financing sources by SAFE surveyed HGEs. As can be seen, only 15.34% used external equity over the six months prior to the survey date. Possible explanations for this include that not all growing companies have the potential to provide the high rates of return which VCs expect (Cochrane, 2005), or that not all companies with such high-growth potential are willing to cede control that comes with VC funding as they are reluctant and because the cost of equity capital is too high. From Figure 27 – which shows that 65% of HGEs used bank overdrafts and 42% used bank loans over the previous 6 months – it is clear that most HGEs are not funded by VC/private equity.

When looking at the factors driving the availability of external financing (credit lines, bank loans, trade credit, etc.), Figure 29 shows that all factors considered are believed to contribute positively to the availability of external finance. All types of companies believe that the willingness of investors to invest and of business partners to provide trade credit can have a significant effect on external finance availability. Yet, compared to other types of firms, HGEs consider “willingness of investors to invest”, “willingness of business partners to provide trade credit”, “access to public support”, to be more relevant to obtaining external financing. In addition, for HGEs, the factors driving the availability of external financing are more dependent on the expected economic outlook than for all other types of companies.

Figure 28 High-growth enterprises’ use of financing.
Data source: SAFE (2020). Related question: Have you applied to the following sources of financing in the past 6 months?
Venture Capital as important source of capital for HGEs

As discussed in Flachenecker et al. (2020), VC is a critical accelerant of growth for many aspiring and existing HGEs. However, in Europe, there are many obstacles to the development of a vibrant VC market. Market fragmentation, lack of staff with the right skills and limited availability of finance are just examples of structural factors that constrain bringing European start-ups to maturity and scale up (Botsari et al., 2021; European Investment Bank, 2019). VC statistics show that the European VC market continues to lag behind the rest of the world both in absolute terms and relative to GDP. The gap between the VC markets in the US and in EU is particularly high at the early and later VC stages though not so or not as much at the seed stage. The amounts invested in the USA exceed those in the EU by a factor of four for early stage VC, and by a factor of seven for late VC\(^45\). The corresponding factors for the EU compared to China are 1 and 2 respectively (see Table 2). It is also worth mentioning here that the development of the VC industry in EU is hampered by the low returns it delivers to its investors\(^46\).

Table 2. Amounts of investments by stage (in billions of euro) for EU27, UK, USA and China in 2020.

<table>
<thead>
<tr>
<th>Stage</th>
<th>USA</th>
<th>EU27</th>
<th>UK</th>
<th>China</th>
</tr>
</thead>
<tbody>
<tr>
<td>Seed stage</td>
<td>2.6</td>
<td>1.5</td>
<td>0.7</td>
<td>0.1</td>
</tr>
<tr>
<td>Early stage</td>
<td>16.4</td>
<td>4.6</td>
<td>2.8</td>
<td>3.3</td>
</tr>
<tr>
<td>Later Stage</td>
<td>97.2</td>
<td>14.9</td>
<td>11.2</td>
<td>30.4</td>
</tr>
<tr>
<td>Total VC</td>
<td>116.2</td>
<td>21.0</td>
<td>14.7</td>
<td>33.8</td>
</tr>
</tbody>
</table>

There exists also substantial distinctions in deal size: while at the seed and early stage there is relatively little difference in terms of average deal size (US vs EU), US late VC-backed companies receive on average higher amounts than EU counterparts. The average Chinese company receives significantly higher amounts at the later stage than its main counterparts, whereas the average deal size in the UK is not very different from the EU (Figure 30).

\(^{45}\) See Kenney & Zysman (2019) for a discussion of the major driver for the huge growth in late stage VC in the US.

\(^{46}\) Arundale (2019), among others, discusses the magnitude of the performance gap between US and EU venture capital funds and what the likely factors of the performance differences are.

\(^{47}\) According to Dealroom experts, this data is very representative of European startup and Venture Capital activity. Dealroom captures more European deals than any other provider (L. Rodriguez Bernate, P. Petitcollin, O. Browne, personal communication 19/02/2022).
When looking into the VC market in individual European countries, Estonia tops the ranking, with the volume of VC investments amounting to 0.98% of its GDP. Note, however, that its ratio was 0.29% in 2019 and that an outlier in late stage financing skews the ratio. With 0.57% of GDP, Sweden performed well by this measure, followed by Finland with 0.42% of GDP. France, Ireland, Netherlands, Germany and Denmark lie above the EU average with 0.25%, 0.24%, 0.19%, 0.17% and 0.16% of GDP respectively, while Spain and Italy lie below the EU average with 0.06% and 0.05% of GDP respectively (Figure 31). This shows clearly that the intensity of VC activity in EU27 continues to lag behind that of the United States (0.64%), and the United Kingdom (0.63%). We also note that seed, early VC and late VC investment vary greatly across the EU. With few exceptions, investments at the late stage as a share of GDP are higher than early stage investments as a fraction of GDP in many European countries in 2020. This may reflect the attitude of VCs to invest more in late stage venture than early stage ventures as they have a lower failure rate. Figure 31 also reveals that in EU countries not all three stages of VC financing are supported thus constraining the full potential of EU companies’ competitiveness and their contribution to the EU’s economic growth and innovation.

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48 Indeed, in December 2020 a company in transportation and delivery services headquartered in Tallinn raised €150 million from VC funds.

49 VC investment as a fraction of GDP was 0.61% in Sweden in 2019. Please note Dealroom statistics can differ from the number reported by other data providers such as Venture Source data for a variety of reasons such as the definition and interpretation of investment stages.

50 This may give the impression that the late-stage segment is better served than early stage. However, as shown in Table 2, EU lags behind US even further in late stage than early stage.
Turning back to the EU27 VC market activity, Figure 32 shows that in 2019 VC firms from all over the world including the EU invested €23 bn in European VC deals, up 41% from the previous year. Compared with the corresponding quarters of the previous year, VC investments decreased by 24% in Q1 2020, and by 35% in Q2 2020. However, in Q3 2020, VC investments have instead increased by 3% compared to Q3 2019 and by 38% in Q4 2020 compared to Q4 2019. So, while overall VC investments held up in EU27 in 2020, Figure 33 reveals that the number of deals declined by 15.1% in Q1 2020, 37.3% in Q2 2020 and in Q3 2020, and by 32.4% in Q4 2020 compared to the corresponding quarters in 2019.
By looking at the trends by stage of investments (seed, early and later stage) over the last five years, the analysis shows that the value of seed VC investments more than doubled between Q1 2015 and Q4 2019, from €165m to €422m. Early-stage VC investments more than tripled between Q1 2015 and Q4 2019, from €424m to €1.4b. The value of later stage investments doubled between Q1 2015 and Q4 2019, from €1.3b to €2.7b. Since the outbreak of the COVID-19 pandemic, the following has occurred:

- For seed, the value of transactions increased in the first two quarters of 2020 while it decreased in the last two quarters of 2020 compared with the corresponding quarters of 2019
- For late stage, the opposite happened – the value of investment declined strongly in the first two quarters of 2020, while it increased largely in the last quarter of 2020 compared with the corresponding quarters of 2019
- For early stage, the value of investment declined in each quarter of 2020 compared to corresponding quarters of 2019 (especially in Q2 and Q4 2020)
When looking at the number of investments by stage, we can see from Figure 37 that there has been a significant decrease in the levels of entrepreneurial finance deals in each quarter of 2020 compared with the corresponding quarters from 2019. These decreases occurred for seed and early stage investments but not late-stage deals. In particular, we can observe that the deal number has decreased by about 36% for seed stage and about 35% for early stage on average across the quarters of 2020. These findings seem to be consistent with the literature (Gompers et al., 2008; Howell et al., 2020; Kaplan & Schoar, 2005; Mason, 2020; Townsend, 2015) which suggests that during recessions greater uncertainty can lead investors to take a more cautious investment approach. This in turn implies that during recessions the funding of seed and early-stage deals might decline to a greater extent. This finding is in accordance with Kraemer-Eis et al. (2021) suggesting that around 4 in 10 BA and 3 in 10 VC respondents have altered their investment criteria to focus more on companies that are already generating revenue. Many respondents are also focusing more on companies that have a longer financial runway. This finding has important policy implications. Firstly, it suggests that company recipients of seed and early stage VC may have little or no growth prospects for an extended period of time. For some, this may imply remaining in incubators for several years. For others, it means turning to sources of finance other than VC to survive. Secondly, it suggests that the financing of applied research and early development stage projects is likely to be a major challenge for many seed and early stage companies.

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51 Note that our findings are similar to the study conducted by (Brown et al., 2020) for the UK.
52 Seed Stage Financing is a relatively small amount of capital provided to an entrepreneur to prove a concept. If the initial steps are successful, this may involve product development, market research, building a management team, and developing a business plan. Early-Stage Financing provides financing to companies completing development where products are mostly in testing or pilot production. In some cases, products may have just been made commercially available. Capital in Later Stage is provided for further plant expansion, marketing, or development of an improved product.
Figure 36. Number of deals in EU27 by funding stage, 2015-2020. 
Data source: Dealroom.co

Figure 37. Number of deals in EU27 by funding stage, 2015-2020- percentage change over the same quarter in the previous year. 
Data source: Dealroom.co

Figure 38 and Figure 39 show the trends in new investments (company’s first round of capital) and follow-on investments (each subsequent round) received by companies headquartered in EU27 countries over the last five years and during the pandemic. As we can see, while new investments remained fairly stable over the last five years, follow-on investments increased rapidly in the last three years. When focusing on quarterly data for 2020, immediately after the start of the pandemic, new investments dropped from €4m to €2m in third quarter of 2020; but they recovered from the low point of the pandemic peaking at €6m in the fourth quarter of 2020. Regarding follow-on investments, VC funds based in EU27 countries continued to make follow-on investments since the onset of the pandemic, reaching €7bn in the third quarter of 2020. As reported by Mason (2020),

Kraemer-Eis et al. (2021) supports this with a complementary finding from the perspective of the VC fund manager:
our evidence suggests that there is less finance available for seed and early stage companies as VC funds are concerned with their portfolio companies, particularly those in the late stage of their financing. Indeed, in many cases, it might have been difficult for VCs to make use of their contacts to set up new partnerships during the pandemic as they were not able to travel to meet entrepreneurs in person and thus could not develop the necessary trust and familiarity. This might have encouraged them to focus on companies in their portfolio and, to invest as part of syndicates in deals that other investors who they trust have invested in\textsuperscript{54}.

\textbf{Figure 38}. VC first-financing versus follow-on VC investment in EU27, 2015-2020 (€bn), Data source: Pitchbook\textsuperscript{55}

\textbf{Figure 39}. VC first-financing versus follow-on VC investment in EU27, 2015-2020 (number of investments) Data source: Pitchbook

between March 2020 and October/November 2020, only 8% of VC funds made no investments (92% continued investing, with 66% even investing in both new deals and follow-ons). Among BA and PE MM respondents on the other hand, 30% made no new investments during that time.

\textsuperscript{54} Kraemer-Eis et al. (2021) is in accordance with this claim: asked about changes to their investment strategy in response to the crisis, the three most frequently mentioned factors by VC respondents were the following: “no change” (40%), “increased focus on existing portfolio companies” (36%), “Co-investing more frequently with other VCs” (22%).

\textsuperscript{55} It is worth noting here that conclusions should be treated with caution due to the difference in the VC datasets used, namely Pitchbook and Dealroom. Indeed, according to Kraemer-Eis et al. (2020), different data providers might indicate different trends in the EU27 VC market.
The sectoral disaggregation of VC activity in EU27, shown in Figure 40 shows that VCs invested primarily in IT and Business and Consumer products and services in 2020 and these sectors dominated VC investment in 2019, although their total market share decreasing from 76.4% in 2019 to 70.6% in 2020. The share for healthcare increased considerably from 14.2% in 2015 to 20.1% in 2020, while the share of energy increased from 5% in 2015 to 9.3% in 2020.

![Figure 40: Share of VC investments in EU27 by sector, 2015-2020 – Calculated on the basis of the amount invested](image)

The sectoral distribution of VC investments measured in terms of the amount invested contrasts sharply with the sectoral distribution measured by number of investments. As can be seen from Figure 40, compared to Q1 and Q2 of 2019, VC investments - measured in terms of the amount invested - in the Business and Consumer products and services sector fell by 40% on average over Q1, Q2 and Q3 of 2020, while it increased by 16% in Q4 2020 compared to Q4 2019. Like the Business and Consumer products and services sector, the value of VC investments in IT decreased by 11% and 34% in Q1 and Q2 of 2020 respectively compared to the corresponding quarters from the previous year, and recovered in Q3 and Q4 2020. The decline of VC investments in Healthcare - in terms of amount invested- was instead not strong during the times of the coronavirus. In the energy sector, VC investments increased largely over Q3 and Q4 2020 compared to Q3 and Q4 2019. A rather different picture emerges when the number of investments is considered. For all sectors, the number of investments fell on average between 7% and 35% as the coronavirus crisis took hold. It seems that Business and Consumer products and service was the industry most heavily affected by the crisis. Firms focused on the tech sectors and healthcare, instead, seems to benefit from the current crisis, as their deal-values are rising during the COVID-19 crisis. Bellucci, A, Borisov, A et al. (2020) confirm this finding. Interestingly, by exploring possible reallocation effects on venture capital investment caused by the coronavirus crisis, they find an important shift of venture capital towards deals in pandemic-related categories, such as deals involving the development of new technologies for addressing health issues and social needs (e.g. remote-healthcare apps, new drugs targeting coronavirus).
Trends in Business Angel investments

VCs are often compared with angel investors. Angel investors, often just called angels, are similar to VCs in some ways but differ because business angels (BAs) are individuals investing their own capital. BAs are typically former entrepreneurs, with strong business or technical backgrounds who provide capital and advice to companies in a specific industry. Since they can keep all the returns on their investments, they have a correspondingly lower cost of capital and can invest in deals that would not work for a venture capitalist. According to EBAN (2018) BAs tend to focus on younger companies than do VCs and make a larger number of smaller investments.

There is evidence that some BAs\(^\text{56}\), who usually precede venture capitalists in the “funding escalator\(^\text{57}\)” are continuing to invest in start-ups during the pandemic (Mason, 2020). In the following, we use information on angel investing that can be found in Dealroom.co to verify this optimistic view – on

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\(^{56}\) BAs represent an important class of private equity investors. They are wealthy private individuals with entrepreneurial or managerial experience who invest their own money in new and early stage companies. They tend to be very “hands on” investors, providing also advice, operational support (e.g. mentoring) and contacts to add value to their investee companies.

\(^{57}\) The “funding escalator” is a useful concept for understanding how companies can successfully fund growth. According to this concept, companies need accessing different types of funding and need for larger amounts of capital as they develop, starting with 3F sources (founder, family, friends), then accessing grants and soft money where available, and moving on to business angels, venture capital funds, development capital funds, and ultimately a stock market listing.
the premise that these data are indicative of the trends within the BA segment\textsuperscript{58}.

At EU27 level, from 2016 to 2019, BA investments decreased to the lowest amount ever over the time period considered. It dropped by about 51\% in 2019 to €75m. In 2020, BA investments experienced a significant increase, it nearly doubled from €89m in 2019 to €175m. Apart from the third quarter of 2020, investments by BAs\textsuperscript{59} increased by 19\%, 431\% and 99\% in the first, second and fourth quarter of 2020 respectively, compared to the same quarters of the previous year. The number of companies supported by BAs decreased by 41\% in 2019 compared to 2015. Between 2019 and 2020, the number of deals dropped by 30\% (see Figure 42).

\begin{figure}[h]
\centering
\includegraphics[width=\textwidth]{figure42.png}
\caption{Business Angel investment in the EU27, 2015–2020}
\end{figure}

The sectors that received the largest share of BA investment amounts in 2020 are Business and Consumer products and services (65\%). The share of business angel investments in the IT sector declined from 35\% in 2015 to 20\% in 2020, while the share of investments in the healthcare increased from 5\% in 2015 to 13\% in 2020. Since 2015, Business and Consumer products and services has continued to be the most targeted sector for BA. In EU27 countries, “Business and Consumer products and services” suffered most from the Covid-19 crises. In contrast, the “health” and “IT” sector were the sector that benefited most.

In 2020, most of the BA activity within the EU was concentrated in Sweden, Germany, Italy, France, Finland and Belgium. When comparing BA investment amounts to GDP, Sweden, Lithuania, Finland, Belgium and Ireland are on top of the ranking.

\textsuperscript{58}There are difficulties in measuring the size of the business angel community and the volume of its activity as BAs often stay anonymous and the details of their investments are rarely disclosed. In addition, BAs are “virgin” angels that have never actually invested but increase the number of BAs in the statistics. Others may have occasionally acted as angels but are no longer looking for investment opportunities. The so-called “invisible market” makes it difficult to get reliable figure on angel investing.

\textsuperscript{59}Our findings contrasts with the EIF qualitative data on BAs (Kraemer-Eis et al., 2021). According to the latest EIF BA Survey, BAs have changed their investment strategy as a result of COVID-19. In particular, their Survey data shows that BAs have decreased their funding, and increased the focus on their existing portfolio companies.
In this section, we analyze the impact of the coronavirus crisis on the capital raised by VC funds located in EU27 countries over the period 2015-2020, and briefly discuss the importance of various limited partners during the pandemic. In 2020, total funds raised by VC firms located in EU27 strongly decreased by 21% compared to the year before, from €7.9bn in 2019 to €6.2bn. This was mainly due to strong decrease in the amounts raised by VC funds with a focus on early stage and generalist VC funds. Figure 44 reveals that after a pick up in Q4 2019, fundraising activity recorded the lowest values in 2020, especially in its third quarter. However, while funding for EU27 companies increased in Q1 2020 compared to the same quarter in 2019, there was a decrease in the fundraising activity of 44%, 51% and 43% in Q2, Q3 and Q4 2020 respectively compared to the corresponding quarters in 2019. The decline in the amounts raised by VC funds located in EU27 countries in the last three quarters of 2020 can be also explained by the large amounts raised in earlier years, notably Q4 2019, so that venture capitalists have sufficient ‘dry powder’ – i.e. funds raised, but not yet invested – (Botsari et al., 2021; Kraemer-Eis et al., 2021).

**Trends in VC Fundraising Activity**

In this section, we analyze the impact of the coronavirus crisis on the capital raised by VC funds located in EU27 countries over the period 2015-2020, and briefly discuss the importance of various limited partners during the pandemic. In 2020, total funds raised by VC firms located in EU27 strongly decreased by 21% compared to the year before, from €7.9bn in 2019 to €6.2bn. This was mainly due to strong decrease in the amounts raised by VC funds with a focus on early stage and generalist VC funds. Figure 44 reveals that after a pick up in Q4 2019, fundraising activity recorded the lowest values in 2020, especially in its third quarter. However, while funding for EU27 companies increased in Q1 2020 compared to the same quarter in 2019, there was a decrease in the fundraising activity of 44%, 51% and 43% in Q2, Q3 and Q4 2020 respectively compared to the corresponding quarters in 2019. The decline in the amounts raised by VC funds located in EU27 countries in the last three quarters of 2020 can be also explained by the large amounts raised in earlier years, notably Q4 2019, so that venture capitalists have sufficient ‘dry powder’ – i.e. funds raised, but not yet invested – (Botsari et al., 2021; Kraemer-Eis et al., 2021).

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60 Generalist VC funds are funds investing in all stages of VC.
Since 2015 public pension funds have played an important role in the development of the VC industry in EU27. After pension funds, the next largest investor class is financial institutions which includes banks and insurance companies. Taken together, this group has provided about 14% of the committed capital on average over the period 2015-2020. Funds of funds are next with 8.6% of the total. Endowment and foundation, and individuals and families have played a small role as limited partner as compared to pension funds, contributing on average to about 4% of all commitments to VC funds. Since 2015, private corporations have contributed about 2.6% of total committed capital, followed by sovereign wealth funds with only 2.1% of the total commitment.

Table 3. Committed capital by limited partner type, 2015-2020.

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<td>€ 4,764.4</td>
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Discussion and conclusions

The aim of this chapter was twofold: first, to update earlier evidence on the financing of HGEs, and the European VC industry (Flachenecker et al., 2020) and second, to provide some evidence of the impact of the economic crisis induced by the pandemic on Venture Capital.

According to the data from the latest ECB SAFE Survey (2020), the share of HGEs which used bank overdrafts and bank loans to finance their business activity is very high (above 60%). Few HGEs raised external equity. Moreover, the share of enterprises which see the willingness of investors and business partners to invest in their companies as major factors affecting their access to finance is higher among HGEs than among all other types of companies. Yet, the access to finance for HGEs is more depending on the general economic outlook than for other types of companies. Regarding the impact of the pandemic on VC, our evidence shows that the pandemic did result in a decline in VC investments and VC fundraising in EU Member states. More precisely, on investment side, we found that since lockdown, the number and the amount invested in business angels, seed, and early stage deals dropped significantly. We also found that many deals were follow-on rounds, suggesting that investors invested in existing portfolio companies, rather than focusing on new deals. Fundraising initially declined, but then recovered in Q4, 2020. Most of institutional investors reduced their committed capital, suggesting that finance is expected to be reduced for many VC-backed companies. This in turn will affect their ability to grow quickly and scale successfully. These findings have some interesting policy implications. Specifically, if seed and early stage companies lack of finance from VCs, and BAs, then this might suggest the need for governments to increase the availability of seed and start-up finance. However, it is important to recognise that VC is not necessarily the appropriate source of finance at all stages. Sources of non-dilutive finance such as grants or deferred loans are particularly important for companies at the pre-commercial stages such as early-stage companies. The findings also suggest the need to support seed and early-stage BAs through the development of enhanced business angel networks and co-financing arrangements which can leverage greater investment in seed and early stage financing. Some of this issues will be discussed in more detail in the next Chapter.
Chapter 8 Policy Measures

This section gives a brief overview of the evolving national policy responses to the COVID-19 pandemic, with a focus on SMEs in general and aspiring and existing HGEs in particular.61

At the start of the crisis in March 2020, the economic policy actions and measures taken by public authorities concerned themselves with keeping the economy afloat using a wide array of measures to mitigate the impact of the Covid-19 outbreak on businesses. The predominant focus was on short-term concerns such as employment preservation and liquidity support. The most common types of measures to support businesses took the form of non-repayable grant payments (usually targeting micro and small businesses so that they could keep paying their operating costs), government-backed bank guarantees for business loans with low interest rates, as well as the deferral of financial commitments such as social security contributions, taxes and loan repayments (OECD, 2020). Many such support measures are potentially relevant to HGEs, depending on the size, age and financial structure of the firm. For example, wage subsidies are important for start-ups while debt measures are important for older and/or bigger enterprises with collateral. The main types of measures which have been deployed are:62

- Some form of deferral or reduction of corporate tax, income tax or social security contributions for SMEs, offered in all EU countries to alleviate liquidity constraints - some schemes focus on postponing the payment of taxes for companies, others stipulate earlier repayments of tax refunds from the previous year
- Wage subsidies - for employees working shorter hours or those who are temporarily laid off - these are particularly welcome by all companies, especially younger start-ups where labour is often the most costly item of expenditure, and have been widely deployed across the EU.
- Loan guarantees - all Member States have introduced, extended or simplified the provision of debt guarantees to enable private banks to continue lending to firms.
- Direct lending - most Member States have increased such lending to SMEs through public institutions/national promotional banks to ensure cash flow in SMEs.
- Direct grants and subsidies - many countries are also providing such support to SMEs and microenterprises to compensate for the drop in revenue. Often these are one-off payments depending on the size of the target enterprise.

Taken together, implementing a broad array of measures helps to mitigate liquidity risks that could trigger a solvency crisis for many businesses. Recent evidence suggests that strong policy support has helped to reduce corporate vulnerabilities and the number of insolvencies in European economies (European Investment Bank, 2021; Gourinchas et al., 2020; IMF, 2020b).63

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61 As discussed in Flachenecker et al. (2020a), very few national policy measures specifically focus on HGEs, given that they are not a clearly defined and recognized policy target group. This section thus focuses on SMEs, as chapter 4 outlines that the share of HGEs is higher among SMEs, and on start-ups, due to their importance in creating a pipeline of potential HGEs as argued in chapter 3.

62 The overview is based on: OECD COVID-19 Country Policy Tracker (available here: https://www.oecd.org/coronavirus/country-policy-tracker/), (OECD, 2020), Eurofound COVID-19 EU PolicyWatch Database (available here: https://www.eurofound.europa.eu/data/covid-19-eu-policywatch), Start-up Nations Atlas of policies (available here: https://www.genglobal.org/atlas), and an overview of policy measures taken against the spread and impact of the coronavirus provided by the European Commission’s Directorate General for Economic and Financial Affairs (DG ECFIN), (available here: https://ec.europa.eu/info/files/policy-measures-against-spread-coronavirus_en). The overview might not be comprehensive or fully up to date, due to the rapid development of the announcement and implementation of new policy measures as well as the fact that the pandemic is still ongoing, and should be thus treated only as indicative.

63 Regarding the general stimulus, the overall size of the liquidity support to the corporate sector varies considerably across Member States (Ebeke et al., 2021; EU Independent Fiscal Institutions, 2021). It should be noted that the assessment of the size of the liquidity provision to the corporate sector remains conceptually challenging, while the overall impact depends on country-specific circumstances, for instance the breadth and scope of the existing automatic stabilizers (IMF, 2020a).
However, the measures listed above are not always suitable for actual or aspiring HGEs, especially those in start-up and scale-up phase (Kraemer-Eis et al., 2021; Kuckertz et al., 2020; Mason, 2020). For example, loan guarantees are channelled through the banking system but start-ups and scale-ups often do not have the necessary collateral to receive a bank loan (Carpenter & Petersen, 2002). Even when they do, it is important that the state guarantees 100% of the loans (as is the case in some SME-focused programmes in Italy and Germany, for example) so that lenders are not hesitant, whereas typically the schemes guarantee 70-90% of the loan principal (Falagiarda et al., 2020). Nevertheless, a valid reason for concern is the possible misallocation of public resources to keep afloat inefficient or even zombie companies which competitive market forces would normally weed out, requiring a nuanced policy response focused on those enterprises that need support and are expected to be viable in a post COVID-19-economy (Group of Thirty, 2020).

A direct loan through public institutions can also be a difficult option especially for smaller enterprises which currently cannot forecast their revenue even a few months into the future. From the perspective of a firm, it might be better to postpone loan repayment as is the case in some European countries (e.g. Belgium, Italy, Hungary, the Netherlands). In short, as the Startup Genome’s Global Startup Ecosystem Report 2020 notes, government support programmes typically have strict eligibility rules and favour companies with revenue, profitability and collateral, which leaves a lot of start-ups “out in the cold”. Indeed, start-ups might fail to meet the relevant solvency criterion needed to access liquidity programmes since they might operate at a loss especially in their first years of business (OECD, 2020).

A positive development in June 2020 has been the extension of the “temporary framework” introduced in March 2020 by the European Commission to relax state aid rules for struggling companies, so that it includes innovative start-ups and other “micro and small companies” as well. At the beginning of the COVID crisis many businesses backed by private equity were prevented from accessing crucial state-backed funds because they are run at a loss to accelerate growth or have sold a large portion of the company to investors. The removal of this impediment enables European governments to channel funds to viable innovation-driven companies that can provide an important source of economic growth post-Covid.

After the early “firefighting” blanket measures for businesses, some European countries turned their attention to providing financial measures and assistance that are more tailored to the needs of aspiring or existing high growth enterprises and that go beyond the traditional debt and debt guarantees. Liquidity support includes, among other things, the provision of equity instruments or bridge financing. The most prominent examples are found in Germany and France. Early on, schemes targeting young innovative companies with growth potential were newly set up or already planned ones fast-tracked. Germany implemented a package of measures with a volume of €2bn to provide additional equity investment for start-ups, for instance by co-investing with private venture capitalists, with a public stake of up to a maximum of 70%. France announced a €4bn liquidity support plan targeting start-ups that included, among other measures, the provision of bridge funding for start-ups (€80m in the form of convertible bonds through the French Tech Bridge fund) and accelerated payment of support for innovation through Bpifrance’s Programme d’Investissements d’Avenir. Other countries with specific programmes for start-up and/or scale-up firms include, for instance, the Netherlands (which has set up a bridge loan programme amounting to €300m),

64 https://startupgenome.com/report/gser2020
65 Kuckertz et al. (2020) analyze the policy response for SMEs and Start-Ups in 40 countries during the first wave of the pandemic. Overall, most countries have provided immediate relief measures, most prominently in the form reducing loan interest rates or improving loan availability, but policy measures explicitly addressing start-ups are the exception.
66 Measures that promote the use of more equity (and equity-like) financing have also been proposed as one possible remedy to reduce a corporate debt overhang and mitigate the risk of “zombification” (Laeven et al., 2020).
67 In June 2020, the French authorities announced another start-up focused package that included, for instance, an increase of the bridge-funding by additional €80m, a direct-loan programme for start-ups (€100m) and the implementation of a technology-fund (€200m) focused on deep-tech start-ups and accelerators.
Denmark (via specialised loan schemes), or Austria (which has introduced a €150m start-up relief fund). Overall, these more specialized schemes seem to have been less frequently implemented across the EU compared to the more traditional ones.

It should be noted that even in more "generous" countries the exceptional measures were intended to be temporary – often limited to 2020 and 2021. This leaves room to continue deploying longer-term measures geared towards reinforcing the innovation potential of national and regional ecosystems. Such transformative measures remain crucial and it is important to continue already existing support schemes. As already emphasized in chapter 3 of this report, the pipeline of high-growth and indeed all entrepreneurial activity driving the economic renewal and growth depends to a big extent on innovative and vibrant start-up activity. Therefore, start-up support remains crucial. Moreover, as Juergensen et al. (2020) underline, policies will need to progressively refocus from the survival phase towards the renewal and growth phase for those potential and existing HGEs that survive, shifting to more structural policies aimed at promoting innovation, internationalization and networking. In this case, different types of HGEs might benefit from different types of longer-term policy responses. For example, some will benefit more from policy support to enter new international markets, while the best policy approach towards specialized-supplier firms might be to strengthen local networks and clusters, promoting the embeddedness of their customers (often multinational enterprises) in their respective territories (Juergensen et al., 2020).

Importantly, the overall policy direction in Europe points to the fact that public support should be mostly oriented to enterprises which can contribute to objectives such as sustainability and digitalization (see also chapters 5 and 6 of this report). In this context, the implementation of the Recovery and Resilience Facility (RRF) provides not only a sizeable European stimulus to a common shock, but also serves as an important impetus to the structural transformation of European economies from which existing and potential HGEs will benefit in two ways: firstly, the Recovery and Resilience Plans (RRPs) drafted by the individual member states include sets of reform and investment proposals that should support the green and digital transition. Secondly, the RRPs are also focusing on addressing country-specific bottlenecks as identified in the European Semester process of the European Commission. These might include, for instance, modernizing and upgrading public administration, strengthening the national innovation ecosystem or facilitating access to finance (see also chapter 7 of this report and Mason (2020)). In conjunction, these supply and demand side policies will not only improve the overall framework conditions for existing and aspiring HGEs, but also create new business opportunities for entrepreneurial activity, with an emphasis on digital and green business models.

Last but not least, from a policy design point of view it should be mentioned that from the perspective of beneficiaries, it is important that any available support measures are accessible through an easy administrative process. If loans, grants and equity require elaborate applications this could deter especially the smallest enterprises that often find themselves hardest hit. Moreover, especially for equity, completely newly designed or completely changed instruments might encumber firms and investors because they require renegotiation of terms and conditions which slow down the funding process. This is why bridge rounds on the exact same conditions as prior funding rounds are particularly user friendly. Finally, promoting risk sharing between public and private investors is very important to increase the leverage of financial schemes and to efficiently spend the taxpayers’ money.

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68 While the section focuses on the national policy response to the COVID-19 pandemic, European initiatives such as the ‘Pan-European Guarantee Fund’ (EGF) or the ‘European Scale-up Action for Risk capital’ (ESCALAR) that has been launched in April 2020 provide important and tailored support for scale-up firms, see also a recent European Investment Fund Working Paper for a general discussion on the scale-up financing gap in Europe (Botsari et al., 2021).

69 In January 2021, the State-aid temporary framework has been prolonged until December 2021 and extended in scope.

70 The discussion of the implementation of “non-financial” support measures for start-ups and scale-ups, such as coaching and mentoring schemes, is, while important, beyond the scope of this chapter.
To sum up: Across the EU, swift policy action has provided liquidity and employment support that is crucial to withstand the immediate negative economic effects of the COVID-19 crisis. In general, existing and potential high-growth enterprises benefit from measures such as loan guarantees or wage subsidies, depending on their firm-characteristics. However, not all Member States have implemented more targeted support schemes that focus on companies in their scale-up phase.

Policy support should not only focus on the immediate survival of viable firms, but at the same time also implement longer term measures to strengthen the HGE ecosystems and help this type of firms to flourish. These range from providing the right framework conditions, in particular for digitalisation and the green transition, to addressing country-specific bottlenecks such as insufficient access to finance or increasing the skill levels of the workforce.
Chapter 9 Conclusions

The analyses presented in this report aim to inform mainly national policy responses in the EU designed to promote innovation-driven growth of enterprises, with particular attention to HGEs.

Going beyond a further development of the data and indicator set presented in the previous 2020 report on HGEs (Flachenecker et al., 2020), this report has drawn on some additional data sources. The purpose of this has been to provide insights on the impact of the Covid-19 pandemic crisis in the hope of being relevant to the fast-evolving situation which policy makers are operating in. Similarly, insights have been provided based on an analysis of the role played by HGEs in previous recent crises and recoveries. In addition, given that the twin green and digital transitions are being emphasized as top priorities in the EU-wide response to the Covid-19 pandemic crisis, specific analyses of environmental innovation and digitalization in connection to HGEs have been included in the report.

A sampling of some the more salient findings and possible policy implications include:

- Analysis of the role of HGEs in previous crises and recoveries shows that they have a positive economic effect over the whole business cycle and particularly larger HGEs in recovery stages. Even though the current crisis is unlike the previous financial and sovereign debt crises, this finding, along with other evidence presented on the importance of HGEs more generally, suggests that policy makers would do well to give specific and preferential attention to this category of enterprise and the framework conditions which favour their development as part of the crisis containment and recovery effort.

- Across the EU, the main at-risk sectors - travel; accommodation; food and beverage service activities; employment activities; advertising & market research; and transportation and storage - account for 22% of HGEs and 28% of HGE employment. Though it is not clear whether and how HGEs react differently to this current crisis compared to ‘normal’ enterprises, a potential policy concern is that a high share of HGEs in sectors at risk could be indicative of vulnerability in certain high-growth ecosystems, thus signaling the need for some form of public policy intervention.

- The most affected venture capital finance category is seed and early finance deals - which are most important for younger enterprises with high-growth aspirations - whereas late-stage deals have shown much greater resilience. Related to this, a shortage of finance results in start-ups born during recessions not only starting smaller, but staying smaller even when macroeconomic conditions improve. This is consistent with numerous calls for action, and indeed action already taken by some governments, to provide resources to compensate for this drop in finance for high-potential and newly-created start-ups so that they can survive the pandemic and eventually have a chance to thrive and reach their full growth potential.

- Publicly-supported environmental innovations and the adoption of digital technologies both correlate with (expected) enterprise growth. The policy related concerns where concrete action would be welcome, stem from, on one hand, the need for more resources and coherence in embedding environmental innovation as part of a broad set of “green” policies as well as targeting enterprises based on their size and innovation experience; and on the other hand, the fact that the shares of EU growth enterprises adopting advanced digital technologies are lower than in the US and the UK in almost all the relevant technology domains, with a high variability across Member States including positive exceptions in the case of Sweden, Netherlands, Spain and Ireland.

The following additional considerations on the different situations in which enterprises can find themselves may be helpful in relation to action or inaction by policy makers in support of high-growth and potential high-growth enterprises:

- In some cases, the crisis can accelerate the decline of enterprises already destined to succumb to competitive and market forces (as part of the normal process of industrial development and
— for these companies, public support should be avoided so as not to artificially prolong their life and create inefficient zombie enterprises;

- In other cases, the crisis has a strong negative impact on enterprises which during normal economic conditions would be viable businesses and which are essential components of the economy such that their demise would have a disproportionate impact beyond the enterprises in question (e.g. for strategic reasons such as preserving otherwise irreplaceable knowledge capital; their provision of essential goods and services – e.g. food, shelter, health-related, etc.; or in playing an essential role in a value chain or cluster on which many other enterprises depend; etc.). This also includes the case of vulnerable but otherwise viable start-up and scale-up businesses with potential to become major creators of economic value and employment but where crisis-induced market failures can lead to their untimely disappearance if not supported. In that context, the policy response to the COVID-19 pandemic should not only focus on immediate liquidity and employment support, but also be complemented it with longer-term measures to strengthen the relevant HGE framework conditions.

- The crisis is also providing opportunities for new and renewed waves of business growth and development which can at least partly compensate for losses elsewhere – some areas of business have seized upon the crisis to expand – especially in IT-dependent activities – e-commerce, telework, health technologies and others.

Finally, as frequently is the case with such policy-oriented research, the case for further more probing research and for more in-depth and up-to-date data emerges from the work conducted. Areas for possible investigation include:

- A better and more detailed understanding of the heterogeneous impact of the COVID-19 pandemic on potential and aspiring HGEs. This could include investigating factors that contribute to the adaptability and resilience of HGEs as well as possible structural changes triggered by COVID-19 in market trends and technological developments that might influence HGEs development going forward.

- A detailed assessment of the national policy response to support start-up and scale-up firms during the COVID-19 shock with the aim to identify effective support measures – this could include investigating the impact of financial and non-financial support measures on HGEs and their local ecosystems. Regarding the former, future research could focus on the role played by government in providing venture capital during times of crisis. Regarding the latter, changes in administrative, fiscal and regulatory requirements as well as other forms of support measures (such as training) could be analyzed.

- An analysis of the financing needs for HGEs during times of crisis, including the potential local bias of investors, in order to assess whether the pandemic has affected the distance between the VC and the investee business.

While the COVID pandemic required swift and decisive policy action, it is clear that it would have been easier to optimize and better orientate public support to the companies and economic actors most in need had more timely and high-frequency relevant data been available. For on-going and future reference, research effort should also be directed at this data question.
Bibliography


List of Figures

Figure 1. Index of turnover (February 2020=100) per NACE rev.2 sector, total, seasonally and calendar adjusted data, EU27. .......................................................... 16
Figure 2. (a) HGEs share of enterprises in Covid19 risk-related sectors (largest turnover drop) out of the total number of HGEs and (b) HGEs employment share in Covid19 risk-related sectors out of the total employment in HGEs. ..................................................... 18
Figure 3. Regional distribution of HGEs in Covid19 risk-related sectors as a share of the total number of HGEs ......................................................................................... 19
Figure 4. Quarter-on-quarter [2020/2019] change in the number of new companies registered in the first and second quarter of 2020 with respect to corresponding quarter for 2019 (percentage) ................................................. 20
Figure 5. Importance of start-ups and young enterprises for aggregate employment .............................................................................................................. 21
Figure 6. Importance of start-ups for job creation. .................................................................................................................. 22
Figure 7. Year-on-year survival rate of start-ups .................................................................................................................. 22
Figure 8. Scenario analysis for employment and the three margins of start-up activity – Italy ......................................................................................... 23
Figure 9. Bounce-back scenario in the number of enterprises, results for aggregate employment – Italy. ......................................................................................... 24
Figure 10. Year-on-year growth rates of GDP in the EU between 2000 and 2019 .............................................................................................................. 27
Figure 11. Share of HGEs in the macro-economy. .................................................................................................................. 28
Figure 12. Distribution of firm-level sales growth pre and post Great Recession .............................................................................................................. 28
Figure 13. High-growth probabilities .............................................................................................................................. 29
Figure 14. Decomposition of aggregate sales growth. .............................................................................................................. 30
Figure 15. Decomposition of aggregate sales growth, accounting for size......................................................................................... 31
Figure 16. Enterprise share of environmental innovations adoption and relevant public financial support (PFS) received for environmental innovation by country. ......................................................................................... 33
Figure 17. Enterprise share of environmental innovations adoption and relevant public financial support (PFS) received for environmental innovation by NACE code (sector). ......................................................................................... 33
Figure 18. In the period 2012-2014, average firm level share growth in turnover and employment .............................................. 34
Figure 19. In the period 2012-2014, average firm level share growth in turnover and employment .............................................. 34
Figure 20. Channels through which environmental innovations relate to firm growth ......................................................................................... 35
Figure 21. HGEs share of environmental innovations adoption and public financial support (PFS) received for environmental innovation by country. ......................................................................................... 36
Figure 22. Environmental innovation funding .................................................................................................................. 37
Figure 23. Share of HGEs that have declared to have adopted partially or fully any digital technology ......................................................................................... 38
Figure 24. Share of “growth firms” respondents that declared that have a strategy or action plan to digitalize ......................................................................................... 39
Figure 25. Share of enterprise that declared that they plan to grow as a result of increased digitalization ......................................................................................... 39
Figure 26. Growth enterprises approach to digital technologies ......................................................................................... 40
Figure 27 European enterprises’ use of financing. .................................................................................................................. 43
Figure 28 High-growth enterprises’ use of financing. .................................................................................................................. 43
Figure 29 Factors driving the availability of external financing ......................................................................................... 44
Figure 30 Deal size in UK, EU27, US and China in 2020 .................................................................................................................. 45
Figure 31. Venture Capital investment as a percentage of GDP, 2020 .................................................................................................................. 46
Figure 32. VC investment in EU27, 2015-2020 .................................................................................................................. 46
Figure 33. VC investment in EU27, 2015-2020 - percentage change over the same quarter in the previous year. ......................................................................................... 47
Figure 34. Venture capital investment in EU27 by funding stage, 2015-2020 (€bn). ......................................................................................... 47
Figure 35. Venture capital investment in EU27 by funding stage, 2015-2020 - percentage change over the same quarter in the previous year. ......................................................................................... 48
Figure 36. Number of deals in EU27 by funding stage, 2015-2020 ......................................................................................... 49
Figure 37. Number of deals in EU27 by funding stage, 2015-2020 - percentage change over the same quarter in the previous year ......................................................................................... 49
Figure 38. VC first-financing versus follow-on VC investment in EU27, 2015-2020 (€bn). ......................................................................................... 50
Figure 39. VC first-financing versus follow-on VC investment in EU27, 2015-2020 (number of investments) ......................................................................................... 50
Figure 40. Share of VC investments in EU27 by sector, 2015-2020 – Calculated on the basis of the amount invested ......................................................................................... 51
Figure 41. Evolution of VC investments in EU27 by sector, 2015-2019 – % change over the same quarter in the previous year invested ......................................................................................... 52
Figure 42. Business Angel investment in the EU27, 2015-2020 ......................................................................................... 53
List of tables

Table 1. Number of HGEs and corresponding employment shares in COVID-19 risk-related sectors .......... 17
Table 2. Amounts of investments by stage (in billions of euro) for EU27, UK, USA and China in 2020 .......... 44
Table 3. Committed capital by limited partner type, 2015-2020. .......................................................... 55
Annex I. Notes on data sources, indicators and their strengths and weaknesses

Enterprise demographics – sectors at risk due to Covid-19 pandemic

Chapter 3 as well as relevant parts of the MS factsheets use business demography data from the Structural business statistics (SBS) of Eurostat related to HGEs and related employment by NACE Rev.2. The first step was to identify the sectors most at risk due to the Covid-19 pandemic. This was followed by the adaptation of the sectorial choice to EU level data on sales dynamics of the industries for a precise, data-driven and targeted approach. More on the analysis can be found in Chapter 3.1 on EU wide discussion of sectors at risk.

The technology/knowledge intensity graph in the factsheets uses manufacturing enterprise demographics data aggregated by sector knowledge/technology intensity following the corresponding Eurostat methodology described (in the annex and also at:

Enterprise demographics – start-up calculator

The start-up calculator uses publicly available data from Eurostat Business Demography Statistics that allows the analysis of the whole economy, as well as of the industrial and service sector in each Member State. This data has been complemented by national statistics such as STABEL (Belgium), DESTATIS (the Federal Statistical Office of Germany providing preliminary data), KSH (Hungarian Central Statistical Office), IC (the Italian Association of the Chamber of Commerce) etc. A more complete list of the national bodies can be found in section 3.2 assessing the impact of the Covid-19 crisis on newly created and young firms. Data from national statistical offices or enterprise registers are not harmonized across countries, and may prevent from quantitative cross-country comparisons. While data quality and availability is appropriate across the EU, there are important gaps in the data, such as in case of Germany and Sweden where the Business Demography dataset does not have enough data to compute the contribution to growth of start-ups and young firms.

Lessons from the Great Recession

The main data source is firm-level data from the biennial Community Innovation Survey (CIS), covering the 10-year window around the Great Recession. Results from the 2004-2006, 2006-2008, 2008-2010, 2010-2012 and 2012-2014 editions are used. The surveys cover enterprises with 10+ employees operating in the business economy of 16 EU Member States. The survey design allows construction of an unbalanced pooled cross-section but not a panel. This limits the possibility to follow HGEs over time, but allows us to analyse the HGE distributions across each biennial wave. The combined dataset comprises over 500,000 observations, representing 2.3 million EU enterprises (stratified sampling), and roughly 433,000 enterprises per wave.

Environmental innovation and enterprise growth

The analysis is based on data from the European Commission’s Community Innovation Survey (CIS) for 2012-2014. The CIS is a harmonised and representative survey of over 60,000 enterprises across the business economy of 13 Member States of the EU. The 60,000 enterprises are stratified and weighted to represent the full population of enterprises with at least 10 employees in the business registries of their respective countries. The 13 Member States account for roughly half of all active enterprises with more than 10 employees in the EU in 2014. According to the CIS, one quarter of enterprises adopted some kind of eco-innovation in this period. More details can be found in Chapter 5.2.

The graph capturing sustainability and eco-innovation performance of HGEs and growing enterprises included in the MS factsheets uses Flash Eurobarometer 486 (2020), Eurostat (2018), OECD (2016), Eurostat CIS (2014), and Flash Eurobarometer 315 (2011) data, standardized around the EU average.
Digitalization

The analysis of the digital transition uses two survey data sources. Flash Eurobarometer 486 is used in the report and the Investment Survey of the European Investment Bank (EIBIS) in the “Indicator framework” graph (see below) of the MS factsheets.

According to the EIBIS 2019 survey, a digital enterprise is one that adopted any digital technology partially or fully. An enterprise is identified as partially digital if at least one digital technology has been implemented in parts of the business; and fully digital if the entire business is organised around at least one digital technology. Enterprises are weighted using value added. The above mentioned Indicator framework includes survey data by standardizing across the EU MS (about the use of HGE indicators in the Indicator framework graph – see below).

According to EU Open Data Portal, Flash Eurobarometer 486 survey on “SMEs, start-ups, scale-ups and entrepreneurship” was conducted in the EU27 and an additional 12 non-EU countries with a focus on European SMEs. It collects data concerning the barriers and challenges that SMEs face in their phase of growth and transitioning to digitalization and sustainable business models. More than 16,000 telephone interviews with enterprises hiring at least one employee between the 19th of February and the 5th of May, 2020 have been made in order to collect responses for the survey.

Financing and venture capital issues

This Chapter draws on three data sources: the European Central Bank’s Survey on Access to Finance of Enterprises (ECB SAFE Survey, 2020) for a more general discussion of external funding sources for HGEs, as well as Pitchbook and Dealroom.co data for venture capital analysis.

Data concerning relevant sources of funding used by HGEs (e.g. grants, bank loans, factoring, trade credit, etc) as well as factors driving the availability of external financing (e.g. general economic outlook, access to public support, enterprise specific outlook, etc.) were considered. However, while the sample of 2,365 HGE companies for the EU27 as a whole is suitable for the analytical purposes of report, the sometimes rather small sample sizes at the level of the individual EU Member States raises robustness concerns. Annex of the factsheets provides detailed information on the sample size of each indicator.

Given that Venture Source discontinued its data service, a switch was made to Dealroom.co for VC data. Dealroom.co is considered to be the main data source for the venture capital analysis. However, we use Pitchbook for the analysis of VC fundraising activity and for the validation of our findings based on Dealroom data.

Dealroom.co is a data provider on start-up, early stage and growth company ecosystems in Europe and around the globe. Their offerings include data sets via SaaS and API and custom reports and bespoke ecosystem platforms. These ecosystem platforms jointly form an interconnected network, strengthening each other in terms of data and knowledge. Data is collected by combining machine learning and data engineering with robust verification processes. The report analyses monthly data on venture capital deals and amounts from 2015 up to Q3-2020. Variables driving the analysis are: amounts (value of the deals), stages (seed, early, later) and industry sectors. Each deal is assigned to the headquarter country of the VC backed company involved in that deal. For the EU 27 there are altogether 22,000 entries (ca. 5,100 for 2020Q3), 16,500 deals with information also about the value of the deals and ca. 5,500 entries where the amount variable is unknown. According to Dealroom.co almost all rounds without an amount are deals undisclosed to the public. For the vast majority these are small rounds that have a very marginal impact on the total funding amounts. There are ca. 20,500 deals where the geographic location (city) of the headquarter company is indicated. Disclosed deals with headquarter country and city information are ca. 15,500. Error! Reference source not found. below summarizes these data. Data about the main non-EU regions contribute to the view about the EU27 coverage (as a general problem, it is important to mention that given the relatively large freedom of VC market actors concerning data provision, data coverage is a general issue for VC market data providers):
Companies in Dealroom.co are classified into 27 different economic activity groups, which are referred to as “sectors”. This classification does not follow any major established industry classification system, but rather is customized to the world of start-ups and emerging sectors. It was however possible to group the Dealroom.co sectors into four broad industries, i.e. Business and Consumer products and services, IT, Health and Energy.

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<tr>
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<tbody>
<tr>
<td>Total number of relevant deals</td>
<td>30,925</td>
<td>22,005</td>
<td>53,952</td>
<td>106,838</td>
</tr>
<tr>
<td>Undisclosed relevant deals (amounts missing)</td>
<td>7,234</td>
<td>5,461</td>
<td>13,749</td>
<td>27,091</td>
</tr>
<tr>
<td>Disclosed relevant deals (amounts included)</td>
<td>23,691</td>
<td>16,544</td>
<td>40,203</td>
<td>79,747</td>
</tr>
<tr>
<td>Relevant deals with HQ city</td>
<td>29,167</td>
<td>20,458</td>
<td>52,080</td>
<td>100,990</td>
</tr>
<tr>
<td>Disclosed relevant deals with HQ country &amp; city</td>
<td>22,480</td>
<td>15,469</td>
<td>39,002</td>
<td>75,835</td>
</tr>
</tbody>
</table>

Launched in 2009, Pitchbook provides data on global venture capital, private equity and public markets. It collects data via more than 960,000 web crawlers and a dedicated research team. As it is one of the major databases used by investors, Pitchbook directly validates the information via its investor relation teams. Furthermore, it has a quality assurance team that uses multiple validation methods and manual reviews to “vet every piece of data”. According to (Retterath & Braun, 2020) Pitchbook, Venture Source and Crunchbase have the best coverage, and are the most accurate databases across the dimensions of general company, founders, and funding information.

Limitations: given the volatilities of the venture capital markets and the relatively larger freedom of the data provision obligations of its actors, data coverage is a general issue for companies providing such data.

**Use of HGE indicators in the “Indicator framework” graph of the EU MS factsheets**

Aiming at a cross sectional benchmarking, the indicator framework graph uses standardized values of the indicators, giving a good overall picture of the relevant metrics. There may be two limitations, though. First, data of various indicators belong to various years depending on the data availabilities. This way it is not excluded that a standardized indicator of year T is marked on the same graph with another indicator from year T-2. This is a technical reason why two indicators represented on this graph should not be directly compared with each other, but instead to be analysed with respect to their own EU averages. Second, it may happen that for an indicator or another the data have the tendency to be clustered in two or more groups (e.g. MS receiving larger amounts of venture capital vs. MS receiving very limited amounts). For such cases it may be a better choice to standardize around as many separate benchmarks as many such clusters can be identified. However, given the limited sample size (i.e. 27 data per indicator) visual representation of multiple benchmarks may not be possible within one single summary graph.

Data sources used in the framework graph include:

**European Innovation Scoreboard**

**HGE employment share:**

Definition: percentage share of employees among HGEs in the 50% “most innovative” industries relative to total employment. It is in fact the “4.1.2 Employment in fast growing enterprises” indicator
of the EIS.
Strength: It is directly linked to the HGEs. It uses Eurostat data, comparable across the board and subject to rigorous methodology and regular data frequencies.
Weakness: The EIS defines the “most innovative industries” category, which seems to cover the same NACE sectors every year, not allowing thus for capturing any structural change. Further to this, HGE might not be linked only/mainly to these industries.

**Innovative entrepreneurship:**
Definition: ratio between improvement-driven and necessity-driven entrepreneurs. It is identical with the “1.3.2 Opportunity driven entrepreneurship” of the EIS, which takes the GEM’s Motivation Index on a three years average basis.
Strength: data used is comparable across the board and is backed by an established methodology and a surveying method (Adult Population Survey – APS) that most probably produces representative samples and that has a flexibility element through the “Special Topic” section that “changes annually and explores aspects of entrepreneurship not already covered in the core APS” (GEM). Further to this, given that it is computed as a three years average, it is probably less “noisy” as a simple annual data.
Weakness: there is no information about the treatment of a possible outlier among the three years averages. Besides, a non-weighted average might overestimate past effects (t-2, t-1 and t have the same weights).

**Linkages among SME innovators:**
Definition: Innovative SMEs collaborating with others, public-private co-publications and private co-funding of public R&D expenditures. It is a composite indicator.
Strength: it uses Eurostat data, which is comparable across the board. The methodology is well described and robust.
Weakness: The composite indicator is made up of three components, 3.2.1, 3.2.2, 3.2.3 of EIS. The first, cooperation agreements on innovation activities (3.2.1) might not be too indicative, because these agreements are not necessarily followed by real co-operation. There is no any information (e.g. size, growth of employment, etc) concerning companies entering the second component (3.2.2) other than the scientific field. Calculating co-publications as a share of the total population may be appropriate, however, there may be more appropriate candidates for the denominator, such as the science base, research expenditures, etc. The third component (privately funding of public research) might be “at risk” of low levels/shares. Another possible weakness of this composite indicator may stem from the fact that data of the three different components is usually from three different years.

**SME innovators:**
Definition: Share of SMEs with product, process, marketing or organisational innovations or innovating in-house among all SMEs.
Strength: similarly to the previous indicator, it uses Eurostat data, which is comparable across the board. The methodology is well described and robust. The data behind the three components have the same source and refer to the same year.
Weakness: possible weaknesses of the Community Innovation Survey, such as data frequency, voluntary base that may result in different countries involved in different years.
A general weakness of the EIS indicators is that they are not comparable in time due to data revised in the external sources that it uses, different time periods covered in two consecutive reports, oldest data used in the EIS T-1 no longer being used in the EIS T. Finally, data transformations have been applied to a slightly different set of indicators from one year to another (EIS Methodological Note, section 4).
**Eurostat**

*HGE number share and HGE average size:*

Definitions: the HGE number share is the percentage share of HGEs of total enterprises with at least 10 employees. The HGE average size is the average size of HGEs (employment definition); employees divided by number of HGEs.

Strength: these two indicators are of particular importance for the HGEs indicator framework. They are two simple, clear metrics with good explanatory power and a good basis for further analysis.

Weakness: potential weaknesses of the structural business statistics.

**EIBIS**

*HGE human capital, HGE availability of finance, HGE labour market regulation, HGE business regulation and taxation:*

Definitions: Percentage of HGEs considering the availability of staff with the right skills / the availability of finance / labour market regulation / the business regulation (e.g., licences, permits, bankruptcy) and taxation is not an investment barrier. The indicators are directly derived from the corresponding survey indicator of the EIB’s Group Survey on Investment and Investment Finance.

Strength: the underlying survey provides valuable firm-level information about investment decisions and investment financing choices on an annual basis. The US enterprises included in the survey offers good benchmarking opportunities.

Weakness: the greatest challenge of the indicators is the objective of ensuring representativeness of the sample especially on MS (and sector) level. Focusing only on SMEs (rather than also on several size categories) could improve this. Another challenge might be the degree of subjectivity allowed by the questions.

**European Investment Fund**

*SME access to loans, SME access to equity:*

Definitions: The SME access to loans is the EIF SME Access to Finance Sub-index (Torfs, 2020) for loans, comprising the use and cost of loans. The SME access to equity is the EIF SME Access to Finance Sub-index for equity, comprising use of equity and the sophistication of the equity market.

Strength: the computing methodology of the two sub-indices are proven to be conducive to robust results. The SME access to loans is composed of five indicators that taken together give a good measurement of the access to loans. Out of these five two are entirely based on statistical facts. The Venture capital investments / GDP, component of the SME access to equity indicator is based on data from a large sample survey of enterprises conducted by Invest Europe that covers 91% of equity capital under management in Europe.

Weakness: four out of the total of seven indicators of the two sub-indices are derived from the Survey on the Access to Finance of Enterprises (SAFE, a survey on ca. 11,000 companies, SME: 90%), which means a significant exposure to the possible weaknesses of one single survey. The equity sub-index consist of only three indicators (which are in turn derived from surveys or estimated), fact considered to be a weakness also by the EIF.

**Global Entrepreneurship Monitor**

*Entrepreneurial skills:*

Definitions: Percentage of 18-64 population who believe to have the required skills and knowledge to start a business.

Strength: see the “Innovative entrepreneurship” indicator described above.
Weakness: Similarly to most of the entrepreneurial skills indices, the GEM TEA has also received two important criticisms: 1. it focuses only on the process of enterprise start-up, failing to capture entrepreneurship that occurs within existing enterprises. 2. its imprecise definition of entrepreneurship allows for too much interpretation among survey respondents:

https://www.fraserinstitute.org/sites/default/files/MeasuringEntrepreneurship2008.pdf Further to the theoretical considerations, data comparability and consistency may be impaired also by the year of the data points that varies between 2013 and 2018: 17 MS with data from 2018, three from 2016, two from 2014, 2015 and 2017, one from 2013 and even a missing data (Malta).

All in all, although it would be good to have the skills represented in the indicator framework, given the weaknesses, I suggest that if this indicator is not too important for the HGE (TBD within the team) we might consider abandoning it.

**Dealroom**

*Venture capital / GDP:*

Definitions: amount of venture capital active in a MS as a share of the national GDP.

Strength: simple, clear indicator based on fact data, comparable across the board and computable for every year, allowing for intertemporal analysis.

Weakness: potential (or real) coverage problems of the venture capital data source (Dealroom). Another issue may arise from the fact that this indicator is implicitly present in the “SME access to equity” indicator described above.
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