#Believe InSmall

Pandemic edition

The VC factor

Data-driven insights into European VC and its resilience to the COVID-19 crisis

INVEST EUROPE

Foreword

Invest Europe

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European venture capital is on a roll. Across the continent, venture capital firms are identifying and helping to fuel businesses that are positively disrupting sectors, creating ground-breaking software and robotics, and developing treatments for life-threatening conditions like cancer. More than that, venture capital is supporting an ecosystem that is powering Europe's economic competitiveness and driving the continent towards a more sustainable long-term future.

2020 was a challenging year for people, companies and countries across Europe. European venture capital did not escape the effects of COVID-19 but responded with characteristic strength. The industry secured another year of investment growth as funding for European start-ups and scale-ups rose for the eighth year running to €12 billion. Moreover, as this report clearly illustrates, investment flowed across the continent – from London, Paris and Berlin to Catalonia, Copenhagen and Dublin. Europe is packed with entrepreneurial talent and populated throughout with hubs that are driving start-up excellence.

It is not only on investment that European venture capital is proving its mettle. Invest Europe has gathered data that shows that the industry is delivering strong returns to investors, performing on a par – or better – than funds from North America and the rest of the world in recent vintages. Venture capital is also at the forefront of job creation with VC-backed companies adding tens of thousands of new staff each year, far faster than the rate for the average European business. The industry's success is attracting more investors from around the globe who are drawn to what is being achieved – and what is possible – in Europe.

As the voice of the European private equity and venture capital industry it has been a pleasure to cooperate once again with the European Investment Fund (EIF), Europe's largest investor in venture capital funds. Through ambitious, in-depth and wide-ranging research, we are developing new insights into venture capital and start-ups across the continent. They show how venture capital is crucial to a strong recovery from the effects of COVID-19 and essential to a brighter future for all.

European Investment Fund

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2020 was a year like no other for the venture capital (VC) industry in Europe. The advent of a global pandemic and its severe effects on public health and the economy provided the ultimate test for the resilience of the European VC ecosystem. The stakes were high: not only had the VC industry just left behind years of turbulence following the global financial crisis, but also at risk was VC's vital support to small and highly innovative enterprises, including many businesses actively engaged in the race against the spread of the virus.

Yet last year the VC industry managed to deliver EUR 12bn new investment volumes, a new all-time high and 7% growth compared to the previous year. Our data-driven insights show that, thanks to their adaptability and ingenuity, European VC firms eventually prevailed over the significant disruptions caused by the pandemic as well as the heightened economic uncertainty, all the while adapting to the new norms of remote and/or hybrid working.

The proven resilience of the European VC industry in the wake of the COVID-19 recession is a remarkable achievement. At the European Investment Fund (EIF), this is perceived as particularly rewarding: for decades, the EIF has strived to contribute to the formation of a resilient VC ecosystem and the emergence of new European VC hubs. This aimed at expanding the availability of robust financing to small and medium-sized enterprises (SMEs), the EIF's core mission.

Without a doubt, the series of swift COVID-19 public support measures – including many deployed by the EIF – also played an instrumental role in the bounce-back of the VC industry over the second half of 2020. That is not to say, however, that the VC ecosystem is set to face a smooth road ahead: for example, structural issues surrounding the European VC exit and scale-up markets have been further exacerbated by the COVID-19 recession. New and creative policy solutions, making the best of digital technologies, will be pivotal in developing an increasingly interconnected and thriving European VC ecosystem, capable of nurturing the tech champions of tomorrow.

For policy to prove effective, it must build on compelling data and research. In this context, we are proud to continue our collaboration with Invest Europe, an institution that contributes invaluably to the VC industry. Invest Europe's authoritative data and market overview as well as EIF's expertise in data-driven market and policy analysis provide the strategic alliance that enables the unique vantage point at the core of this second edition of "The VC factor".

The report in a nutshell

The year 2020 will go down in history as a time of extraordinary health crisis and unprecedented public policy response. As the COVID-19 pandemic quickly swept up the globe, disrupting every aspect of our personal and professional lives, venture capital (VC) managers as well as start-uppers found themselves in uncharted territory and unable to continue their business as usual.

Start-ups' concentration in large hubs continues to increase. But VC firms remain much more clustered together than start-ups.

However, before the pandemic struck and following the global financial crisis, the European VC industry had been experiencing a period of significant and sustained growth. Where did most of this growth occur, and how has it shaped the VC ecosystem? Let's look at where VC went and also at where it came from.

It turns out that VC firms tend to cluster together much more than their investees. More than 50% of all VC firms operate in very large cities in comparison to 34% of all start-ups. As a result, a few important hubs capture a significant share of the VC activity in Europe. What is more, over the last decade the activity from very large cities increased by 8 percentage points (pp). More geographically clustered VC firms might partially explain the increasing concentration on the side of start-ups as well – up by 12pp since 2007.

High regional wealth does not lead directly to VC leadership. A favourable policy mix is pivotal at translating wealth into entrepreneurial growth and success.

To dig deeper into this trend, we put on a regional lens. Ranking sub-national regions according to volumes disbursed and received, we find that fourteen "high profile" regions appear in both sides of the equation. Repeating the ranking over time brings similar results, confirming that European VC has become increasingly more concentrated: concerns were raised that this might be reducing opportunities for entrepreneurs away from the larger VC hotspots.

Could this concentration simply be due to overall higher wealth in the leading regions? Not quite: it appears that economic activity is only a bland predictor of leadership in VC activity. A favourable policy mix is pivotal when it comes to how effective regional ecosystems are at translating wealth into entrepreneurial growth and success.

A more interconnected VC ecosystem might provide one effective solution against the rising concentration of start-ups.

The analysis also unveils regions that are more specialised in either receiving or disbursing capital, which by nature must rely on other hubs to thrive. The "communication" among VC hotspots is particularly relevant for policy, because it relates to the interconnectedness of the European VC ecosystem. In fact, a more interconnected VC ecosystem might provide one effective solution against the side effects of the rising geographical concentration of start-ups.

Around a month into the pandemic, the VC industry saw a rapid decline in the number of investments.

Little did the VC industry know that it was about to face an even greater threat. As the health crisis began to unfold, many pundits warned about the looming "black swan", more than a decade after it last appeared during the global financial crisis.

Weekly data show that from mid-January to mid-February 2020, VC investments were significantly higher than the average in 2018 and 2019. Around a month into the pandemic, however, the VC industry saw a rapid decline in the number of investments.

Except for the "winner" healthcare sector, the pandemic's impact reverberated over the entire VC industry.

Our analysis shows that the three-and-a-half-month period after the announcement of the pandemic witnessed a statistically significant 13.6% drop in the number of new deals. Exit rates decreased even more, by 43%, due to the heightened market uncertainty and the significant restrictions affecting travel and, broadly speaking, doing business during the first half of 2020.

Interestingly, we do not see a comparable fall in the total volume of new VC investments. In fact, volumes up until the middle of 2020 were comparable to the 2018-2019 average. Even though VC firms made fewer deals, those that did provided, on average, 19.3% larger financing in the case of initial investments.

Perhaps surprisingly, the pandemic did not disproportionately affect specific categories of VC financing, with the exception of the healthcare sector, an obvious "winner" in terms of new deals. We do not find many significant differences across the various sectors of the economy, stages of VC investment, ages of invested companies or other breakdowns.

VC firms in regions under lockdown operated at 15 to 20% lower activity levels than they could have had in the absence of such measure.

One more way to measure the impact of COVID-19 is to exploit lockdowns and their uneven geographical implementation across Europe. We find that VC firms in regions under lockdown signed up to 20% fewer deals than investors located in regions with no restrictions to mobility between the eighth and the tenth post-lockdown week. The difference in volumes between the two groups is even larger: 143% on average. This sums up to about EUR 250m worth of VC activity lost due to lockdowns during those three weeks.

The VC industry did not experience a case of long COVID, despite the symptoms lingering for quite a while during 2020.

Luckily, the effects did not last long. As the summer of 2020 began, the activity of VC firms in constrained regions was once again comparable to the no-lockdown benchmark. The impressive recovery overlaps and is perhaps explained by the gradual lifting of restrictions in the lead-up to summer 2020. What is more, many regions experienced a second lockdown some eight months after the first (on average). Yet this was not followed by a second dip in activity. By then, VC firms under lockdown had adapted to the new normal, developing some type of immunity against new lockdown waves.

Ultimately, despite the measurable harm of the initial 2020 lockdowns, the VC industry did not suffer from a case of long COVID. By the end of 2020, VC firms under strict lockdown had caught up in terms of activity rate (both in deals and volumes) with their no-lockdown benchmark.

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Chapter 1

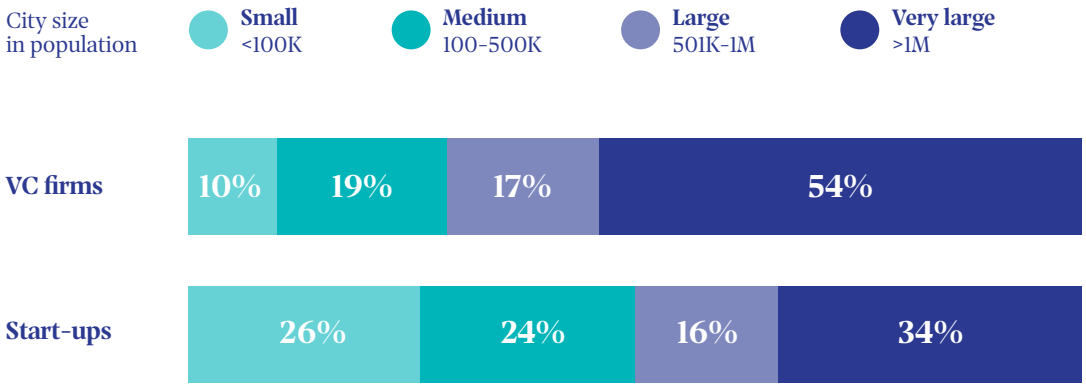
A new glance at the European VC ecosystem

How concentrated is the VC industry in Europe?

The last time we crunched the numbers,[4] it was all about measuring whether (and how much) start-ups in the European VC ecosystem were geographically concentrated. Four years of new data and EUR 32.3bn of new VC investments later, this is still a hot topic. So we're doubling down on our efforts to provide data-driven insights on the geography of VC in Europe.

How? This time, we're not only looking at where the money *goes*, but also at where it *comes from*. We will refer a lot to this dual origin/destination perspective throughout the chapter. Let's start with an analysis of the European VC hotspots, using the smallest geographical unit in our dataset: cities.

VC firms and start-ups distributions, by city size, *2007-2019*



The Data

Our dataset results from a partnership between EIF and Invest Europe, enabling a comprehensive overview of the European Venture Capital (VC) market. Our data include investments by 2,611 VC firms towards 32,114 start-ups, from 2007 to 2020. Note that the data cover activity flowing from Europe (including to countries outside of Europe) as well as flowing to Europe (including from non-European countries). Activity from non-European countries to non-European countries is not covered.

To avoid confusion, when we talk about VC firms, we specifically mean firms with VC activity flowing from Europe (including to non-European start-ups). Similarly, when talking about start-ups, we mean VC activity flowing to Europe (including from non-European VC firms).

2,611
VC firms

32,114
start-ups

[4]Crisanti, A., Krantz, J. and Pavlova, E. (2019). The VC factor: Data driven insights about VC-backed start-ups in Europe. Joint EIF – Invest Europe study. First online 5 December 2019.

Mind the... terminology

Throughout this report, we use "start-ups" as a collective term for young and innovative businesses that received seed, start-up or later stage VC financing. The three investment stages are defined as follows:

1 Seed

No mass production/ distribution yet. Investment aimed at completing research, product definition and/ or design, creating prototypes and/or market testing.

2 Start-up

Fully developed product or service, but not commercially sold. Investment aimed at starting mass production/distribution and/or covering initial marketing.

3 Later stage

Businesses generating revenues (not necessarily profitable), likely to have already been VC-backed. Investment mainly aimed at scaling up operations.

It turns out that VC firms tend to cluster together much more than their investees. More than 50% of all VC firms operate in very large cities (> 1 million inhabitants), while only 10% are based in small cities (< 100k inhabitants). This result is perhaps more striking when compared to the distribution of start-ups. While we can also find a plurality of start-ups' headquarters in very large cities (34%), the overall distribution is more even: around a quarter of start-ups operate in small cities and almost the same in medium cities (between 100k and 500k inhabitants).

> "VC firms tend to cluster together much more than their investees."

Which are the most active VC hubs? Interestingly, eight out of the top 10 activity hubs by money flowing in, are also in the top 10 ranking in terms of money flowing out. Granted, a hub typically won't take the exact same spot in both rankings, and will show different volumes on either side.

Nevertheless, data show that a few important hubs tend to capture a significant share of the overall VC activity in Europe. How significant? The 12 distinct hubs listed in our two top 10 charts are the source of 61% of all investment volumes, but "only" account for 40% of received volumes. In a way, these important hubs are *net contributors* to the VC ecosystem (we'll return later to this notion) since, on average, more than half of the money in these 12 hubs flows out to locations perhaps less in the spotlight. ▶

Top 10 origin and destination hubs for VC
2007-19

Top 10

	Origin hubs	Destination hubs
1	London *23%*	London *12%*
2	Paris *15%*	Paris *7%*
3	Stockholm *5%*	Berlin *6%*
4	Munich *4%*	Stockholm *3%*
5	Berlin *3%*	Cambridge *2%*
6	Amsterdam *3%*	Munich *2%*
7	Copenhagen *2%*	Barcelona *2%*
8	Helsinki *2%*	Dublin *2%*
9	Madrid *1%*	Madrid *1%*
10	Barcelona *1%*	Amsterdam *1%*

Is there an increasing concentration of start-up investments?

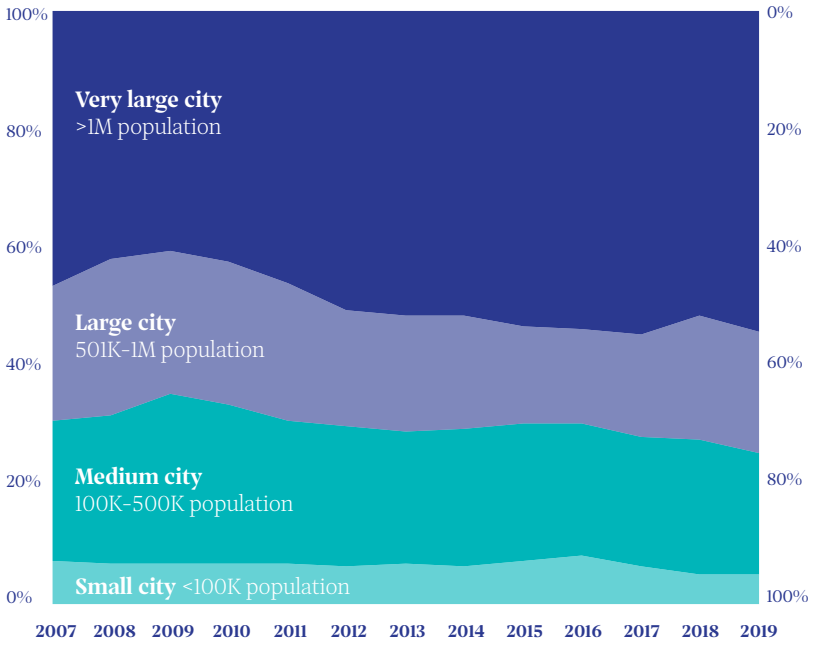
VC firms have historically gravitated toward larger cities. Nevertheless, investment activity coming from very large cities continued to surge, increasing by 8 percentage points (pp) over the last 12 years. The increased share of VC firms in very large cities caused a proportional reduction in the shares from other city size categories: VC firms located in small cities have consistently invested less than 10% of all volumes. A stable 40% of investments have typically come from VC firms based in a medium- or large-sized city. ▶

More geographically concentrated VC firms might partially explain the increasing concentration also on the side of start-ups. Back in 2007, investments in start-ups located in very large-, small- or medium-sized cities each made up around 30% of all volumes. Fast forward to 2019, the share of volumes invested in start-ups based in very large cities has increased to more than 40%, while the share in the other two groups showed a pronounced decline.

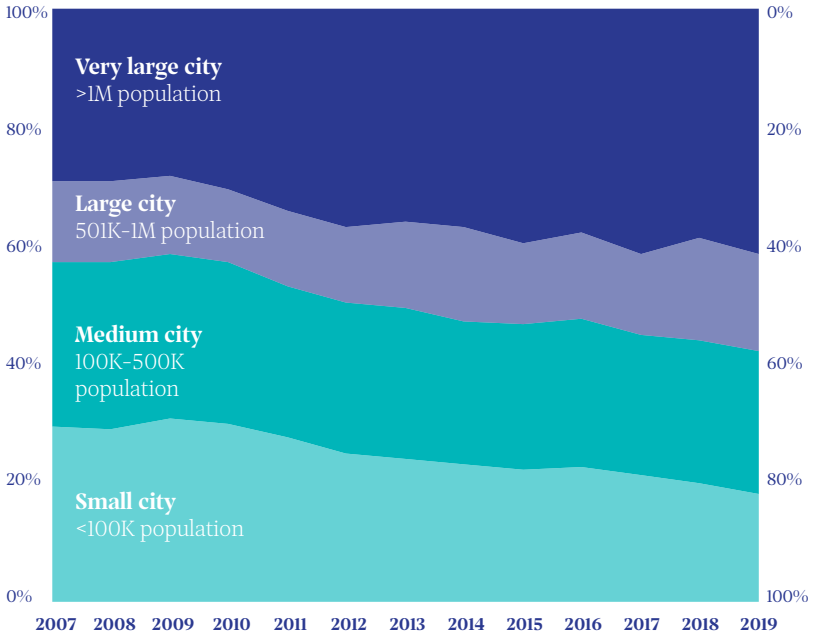
Why are entrepreneurs increasingly opting to start their business in larger cities? Perhaps, to be more accessible to potential investors. In fact, we find a positive correlation between the population size of cities hosting VC firms and start-ups respectively: VC firms are more likely to invest in cities of the same size as the one they are in. There could be other reasons as well, including better access to various kinds of start-up services and overall infrastructure.

Some academics and policymakers have voiced their concern about the rising concentration of VC activity in European megalopolises. The claim is that this might be reducing opportunities for start-ups located outside of the larger VC hotspots and unwilling to relocate.

Yearly distribution of investment by city size: *origin*



Yearly distribution of investment by city size: *destination*



> **VC firms are more likely to invest in cities of the same size as the one they are in.**

With more than 5,100 unique city locations for VC firms and start-ups, too much noise would come out of any additional city-level analysis, so it's best to close that here. Instead, we can carry on with regional aggregates, i.e. at NUTS-2 level. Much like our previous ranking of hubs, we now rank regions according to investments disbursed and investments received. We also consider time trends by repeating the exercise over three different periods.

Much like our ranking of VC city hubs, many of the top regions in terms of VC flowing out are also in the top 20 for VC money flowing in. How many are these "high profile" regions? Out of the top 20 NUTS-2 regions for investment origin during the analysed period, 14 "high profile" regions also show up in the top 20 for investments destination.

Adding time trends shakes things up to some extent, but perhaps less than we could have imagined. Since 2007, seven and six regions have dropped out of the top 20 ranking for origin and destination respectively. The regions that did, had never showed up in the top half of the ranking to begin with.

Between 2007 and 2019, the regions in the top 20 to gain the most positions were Berlin as origin (from 26th in the years 2007-10 to fourth position in 2016-19) and Dublin as destination (from 23rd in 2007-10 to 9th in the last four years). At the opposite end, Darmstadt was the origin region to lose the most ranks (from fifth in 2007-10 to 33rd in the last period), while Oslo the destination falling the most in the ranking (from 9th in 2007-10 to 21st in 2016-19).

Mind the... missing data

Sometimes, we won't have information on VC firms' and start-ups' regional locations. Assuming that such information is missing at random (in other words, missing data patterns are unrelated to VC firm and start-up attributes), we re-allocate investments and volumes for missing regional locations following the distribution of the observed data. To maintain the dual origin/destination perspective, when we know the investment's origin (destination), but not the destination (origin), we re-allocate originated (received) volumes across regions previously connected to such origin (destination) . In the rare event that locations at both ends are missing, we redistribute such volumes according to all observed origin/destination investment flows.

Weighting approach

Since missing locations force us to work with a subset of the original activity data, we weigh our sample so that totals are consistent with the full dataset. To this end, we use the raking algorithm (Deming and Stephan, 1940),[5] which requires a number of characteristics that accurately predict the existence/absence of data. We implement the algorithm using six key re-weighting dimensions: origin NUTS-2 (incl. re-allocated volumes, see box on the left), destination NUTS-2 (incl. re-allocated volumes, see box on the left), investment year, semester of the investment year, investment stage and the sector in which the start-up operates.

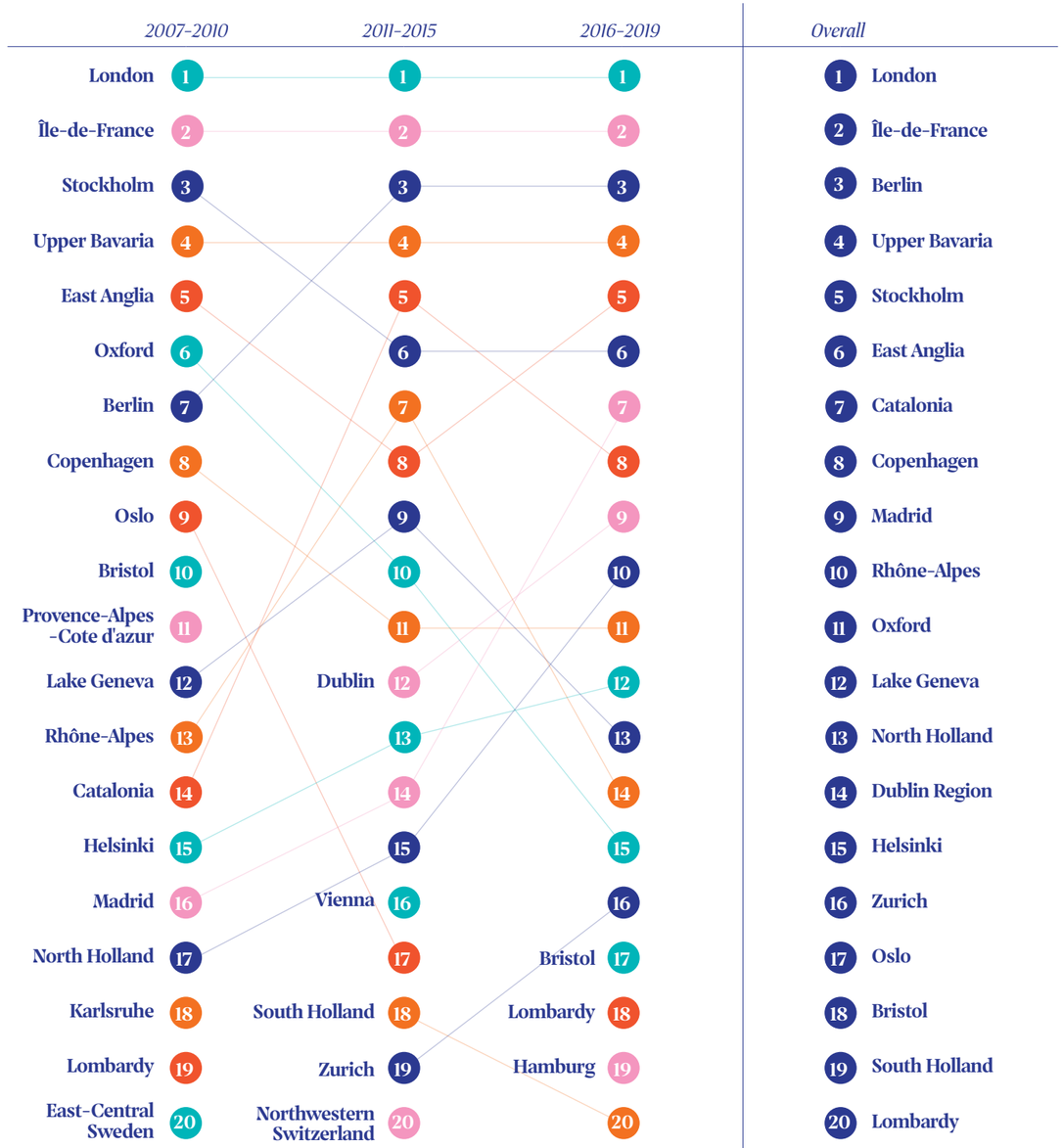
[5] Deming, E. W. and Stephan, F. F. (1940). On a Least Squares Adjustment of a Sampled Frequency Table When the Expected Marginal Totals are Known. Annals of Mathematical Statistics, 11(4): 427–444.

Top 20 regions *origin*

NUTS classification system

The nomenclature of territorial units for statistics (Nomenclature des Unités territoriales statistiques – NUTS) is a Europe-wide geographical classification system maintained by Eurostat. This system sub-divides the territory of the European Union (as well as members of the EFTA) into three hierarchical levels, known as NUTS-1, NUTS-2 and NUTS-3. This classification enables cross-border statistical comparisons at various regional levels within the EU. In particular, this chapter uses the NUTS 2021 classification system, valid since January 1, 2021.

Top 20 regions *destination*



Follow the money, find a VC hotspot?

The data confirm that the more regions are economically developed, the more they are likely to become a breeding ground of VC firms and start-ups. Since VC firms and start-ups tend to cluster together to gain from network effects and other positive externalities, it will surprise no one that these economically developed regions rank high in both origin and destination of VC investments.

Is this really the full story, however? To find out, we strip away the effect of the regions' economic activity and check whether the same VC hotspots still remain at the top.
In other words, we create a new ranking that normalises VC investments by regional GDP.

With this, we can answer the question: which regions are more efficient at turning one Euro of wealth into one Euro of VC investments (either disbursed or received)? ▼

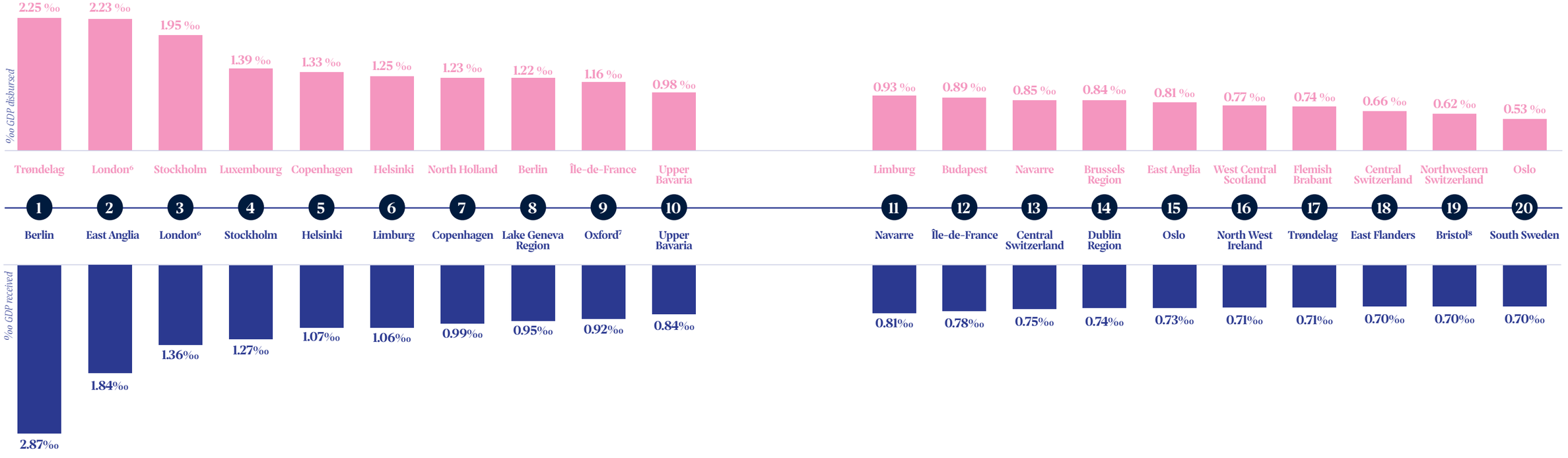
Let's start by analysing regions that still stand out after taking into account their VC activity over GDP. Out of the 14 "high profile" regions (appearing both in the top 20 VC investment origins and destinations), 10 remain in the ranking after controlling for their economic activity. However, the new ranking reveals some interesting shifts: for instance, in terms of received VC the region of London loses the lead to Berlin, where VC represents a higher share of the region's GDP.

One of the largest drops affects the region of Île-de-France, where Paris is located. Despite its high absolute investment volumes, second only to the region of London, accounting for GDP causes the region to drop to the 9th position for relative VC disbursements and 12th in terms of relative VC received.

What about the four "high profile" regions that drop out of this new ranking altogether? These include the regions of Darmstadt and Cologne in Germany, Catalonia and Madrid in Spain and Zurich in Switzerland. In addition, some non-"high profile" regions, but still either in the top 20 for disbursed or received VC also drop from the new ranking (for instance: Hamburg and Cologne in Germany, Lombardy in Italy, Antwerp in Belgium).

On the other hand, we notice some regions entering the new top 20, despite their relatively low share of total VC investments. A noteworthy example is Limburg in Belgium, ranking 11th in VC disbursements and sixth in VC received. Other examples include the Navarre region in Spain, and the region of Central Switzerland (where VC hubs like Zug are located).

Top 20 regions: *origin and destination volumes as a ‰ of regional GDP, 2007-19*



⁶To better represent the overall region's VC activity and its GDP, data for London combine the following NUTS-2 regions: UKI3, UKI4, UKI5, UKI6, and UKI7.
⁷Shorthand for the NUTS-2 region of Berkshire, Buckinghamshire, and Oxfordshire.
⁸Shorthand for the NUTS-2 region of Gloucestershire, Wiltshire and Bath/Bristol area.

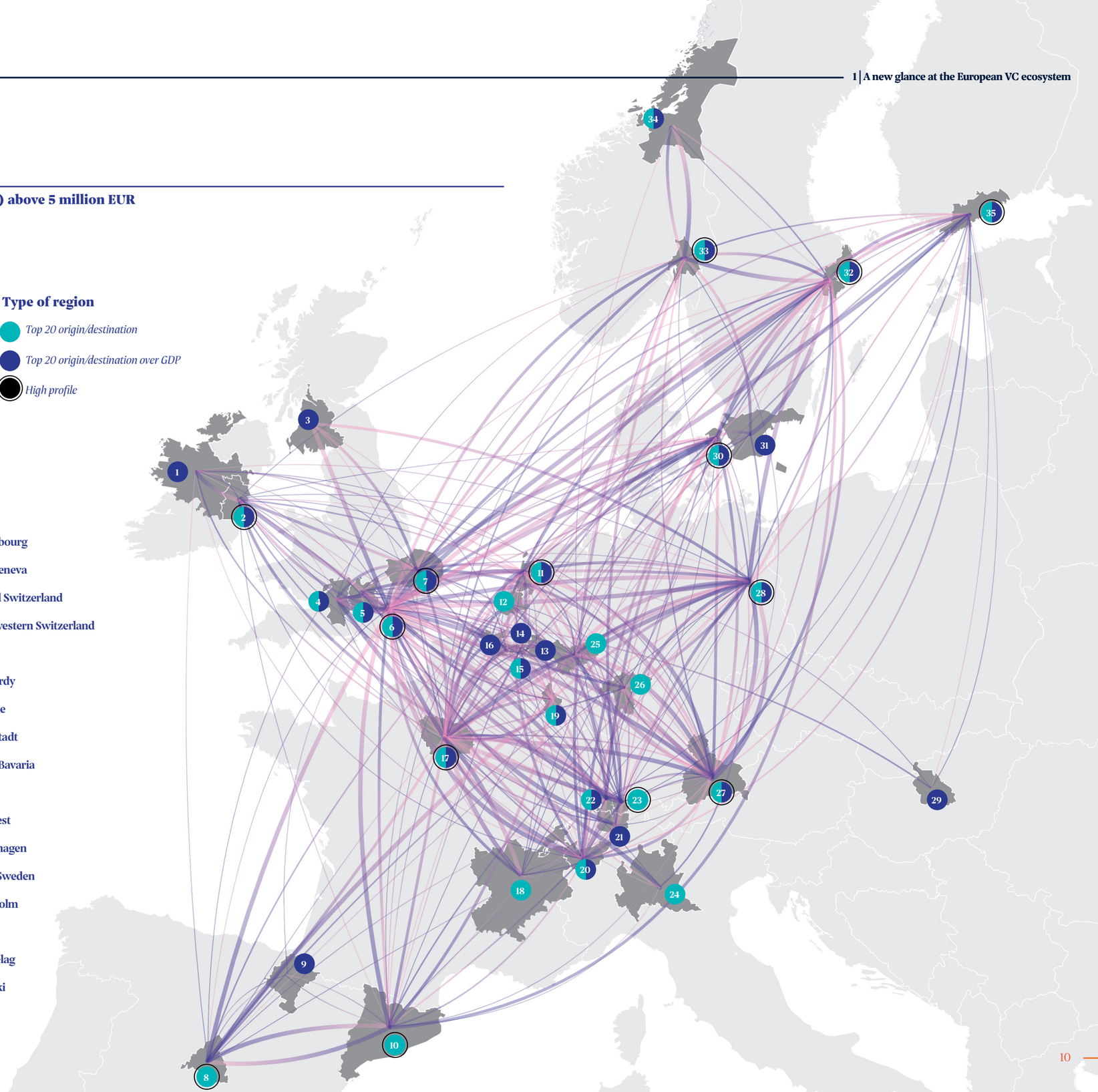
What lessons can we draw from this highly simplified analysis? First, that large economic activity is only a bland predictor of leadership in VC activity. Among the other explanatory factors is a favourable policy mix supporting the local VC ecosystem. This is pivotal when it comes to how effective the regional VC ecosystems are at translating wealth into entrepreneurial growth and success.

Second, this analysis helps put under the spotlight regions that are more specialised in either side of the VC market. For example, the regions of Luxembourg and North Holland (where Amsterdam is located) rank fourth and seventh respectively in terms of relative VC disbursements over GDP. Yet, they are not featured in the top 20 in terms of received VC over GDP. At the other end of the spectrum, we find the regions of Lake Geneva and Oxford, which are particularly attractive destinations for VC investments, but they do not feature a similarly pervasive VC firm activity.

Since these regions invest more than they receive (or vice versa), in order to thrive they must rely on other hubs to receive (disburse) the appropriate VC funding. The "communication" among VC hotspots is particularly relevant for public policy because it signals how integrated the broader European VC ecosystem is. ▶

Deeper connectedness of the European VC ecosystem helps VC hotspots thrive.

VC investment flows (in and out) above 5 million EUR of top regional hubs, *2007-19*



Net contributors and net beneficiaries

We conclude this chapter with a glance at how interconnected the European VC ecosystem is. We do this through the eyes of regions that gain the most from such interconnectedness, of which there are two kinds: net contributors (regions that disburse more than they receive) and net beneficiaries (regions that receive more than they disburse).

Half of the top 20 net contributor regions are also in the top 20 of overall disbursed volumes. The other half of the top 20 net contributors is composed of relatively lesser known VC hubs that would typically support a nearby national (or even regional) VC hotspot. At the top, we find Luxembourg, whose disbursements are 5.6 times higher than the received volumes. At the bottom of this ranking, we find Cologne, where money flowing out was 1.3 times the money flowing in.

Only five of the top 20 net contributors are also "high profile" regions: North Holland (Amsterdam), London, Stockholm, Île-de-France (Paris) and Copenhagen. These can be considered the "beating heart" of the European VC ecosystem, since they disbursed about 50% of VC volumes in 2007-2019. On average, these regional hubs' disbursements were 1.6 times than their received volumes. ▼

Top 20 net contributor regions, *2007-19*

Rank			Investments disbursed (EUR M)	Investments received (EUR M)	No. beneficiary regions	Disbursed/ Received
1	**Luxembourg**	*LU*	868	154	60	5.6x
2	**Kent**	*UK*	274	84	30	3.3x
3	**Trøndelag**	*NO*	633	199	11	3.2x
4	**Darmstadt**	*DE*	848	300	56	2.8x
5	**Brussels Region**	*BE*	817	321	36	2.5x
6	**North Portugal**	*PT*	315	140	12	2.3x
7	**North Holland**	*NL*	2,275	1,170	76	1.9x
8	**Emilia-Romagna**	*IT*	155	83	12	1.9x
9	**Piedmont**	*IT*	177	99	18	1.8x
10	**Flemish Brabant**	*BE*	408	238	41	1.7x
11	**London**	*UK*	14,162	8,629	151	1.6x
12	**Budapest**	*HU*	476	292	21	1.6x
13	**Düsseldorf**	*DE*	393	256	27	1.5x
14	**Stockholm**	*SE*	3,312	2,161	53	1.5x
15	**Lazio**	*IT*	184	120	20	1.5x
16	**Espace Mittelland**	*CH*	111	74	18	1.5x
17	**Île-de-France**	*FR*	9,893	6,618	112	1.5x
18	**Antwerp**	*BE*	363	262	34	1.4x
19	**Copenhagen**	*DK*	1,788	1,332	55	1.3x
20	**Cologne**	*DE*	730	574	56	1.3x

The top 20 ranking of net beneficiaries mostly contains regions not elsewhere featured in this report. As a result, it is much more common to find regions where significant investments are flowing in against very limited or absent local origination activity, than the opposite. Most of the net beneficiary regions thrive on a well-connected VC ecosystem, and are directly linked to some of the more "high profile" regional hubs. ▼

For instance, the UK region hosting VC hubs like Oxford receives significant influx of capital from London.

What is the lesson to draw from here? If the rising geographical concentration of start-ups is indeed a cause for public policy concern, a more interconnected VC ecosystem and the rise of net beneficiary and net contributor regions might provide one effective solution against its undesired effects.

Net contributors vs net beneficiaries

Like before, we build a new top 20, ranking the difference between the investments received and disbursed by region and identifying those that have the highest disparity. To make this ranking meaningful, we focus on regions with non-zero received or disbursed VC activity. We also focus exclusively on regions at least above the median of the distribution of disbursed/ received volumes.

Top 20 net beneficiary regions, *2007-19*

Rank			Investments disbursed (EUR M)	Investments received (EUR M)	No. contributor regions	Received/ Disbursed
1	**Loire Region**	*FR*	17	328	11	17.9x
2	**Languedoc-Roussillon**	*FR*	18	275	11	14.0x
3	**East-Central Sweden**	*SE*	34	413	15	11.1x
4	**Central Jutland**	*DK*	24	270	12	10.4x
5	**Hainaut**	*BE*	16	186	10	10.3x
6	**South Sweden**	*SE*	44	488	22	10.0x
7	**Bedfordshire and Hertfordshire**	*UK*	50	403	11	7.0x
8	**Swabia**	*DE*	27	168	15	5.1x
9	**Southern**	*IE*	28	162	6	4.7x
10	**Bristol**	*UK*	155	801	32	4.2x
11	**Dresden**	*DE*	49	242	23	4.0x
12	**Tuscany**	*IT*	26	128	9	3.9x
13	**Oxford**	*UK*	269	1,282	29	3.8x
14	**Aquitaine**	*FR*	51	226	15	3.4x
15	**Merseyside**	*UK*	21	89	9	3.2x
16	**Nord-Pas de Calais**	*FR*	61	215	9	2.5x
17	**Greater Manchester**	*UK*	102	359	23	2.5x
18	**Alsace**	*FR*	38	132	8	2.5x
19	**Midi-Pyrénées**	*FR*	142	491	15	2.5x
20	**Bucharest-Ilfov**	*RO*	35	118	9	2.4x

Translating research to drugs

CD3

“We have to invest more in the discovery of drugs targeting dangerous and emerging viruses, and already start working now to counter the next pandemic” explains Patrick Chaltin, Managing Director of CD3, the Centre for Drug Design and Discovery. “Together with Prof. J. Neyts from the Rega Institute, we’ve been highlighting that such a pandemic could happen for a long time and that antiviral drugs are needed alongside vaccines.
I think that in 2-3 years we could have a highly potent coronavirus drug in clinical development that could make the difference between life and death. ”

Chapter 2

Unmasking 2020: a year in VC

> “The goal? To try and imagine a 2020 without COVID-19.”

On January 9, 2020, the World Health Organisation (WHO) announced a novel coronavirus outbreak. The new virus showed potential to escalate into a public health emergency of international concern.[9] As the initial worries were sadly confirmed, many experts and pundits warned about the looming “black swan”, more than a decade after it last appeared during the global financial crisis.[10]

The WHO eventually declared COVID-19 a fully-fledged pandemic on March 11, 2020, following a 13-fold increase in the number of cases outside China, and tripling of the number of affected countries.[11] To curb the initial spread of COVID-19, governments across the world resorted to a wide range of social distancing measures, in technical terms non-pharmaceutical interventions. Among these, lockdowns (or stay-at-home orders) emerged as the most symbolic measure during the first wave of COVID-19 in Europe.

The COVID-19 pandemic disrupted every aspect of our personal and professional lives, and the VC industry was no exception. VC managers as well as start-uppers found themselves in uncharted territory, unable to continue their business as usual.

Now that 2020 is well behind us, we can look back and try to measure the potential damage brought by COVID-19 to one of the most important financial channels for small but highly innovative companies. To “unmask” the effects of COVID-19, in the rest of this report we use an appropriate mix of hard data and statistical techniques. The goal? To try and imagine a 2020 without COVID-19.

[9]World Health Organization. 2021. Timeline of WHO's Response to COVID-19. Accessed 13 July 2021.
[10]Interestingly, the author that first coined this expression did not actually consider it appropriate for the case of the COVID-19 pandemic. See article.
[11]WHO Director-General's opening remarks at the media briefing on COVID-19.

Part 1

Keeping distance or defying the norms: how did VC fare in 2020 compared to earlier years?

How to track VC's immediate reaction to the pandemic?

One straightforward way to do this is to benchmark VC activity in the first half of 2020 against the average of earlier years, in this case 2018 and 2019. Weekly data show that from mid-January to mid-February 2020, VC investments were significantly higher than the average in 2018 and 2019.

In the 20 days following March 11, the VC market still closely tracked the trends in the previous two years. However, around a month into the pandemic, the VC industry saw a rapid decline in the number of investments. Up until mid-2020, investments followed the trajectory of 2018 and 2019, however in some weeks they were significantly below the historical average.

> "Around a month into the pandemic, the VC industry saw a rapid decline in the number of investments."

The data also show that the number of firms undertaking a VC investment significantly fell in the second quarter of 2020. Investing VC firms are, by definition, a share of all VC firms active in the market, so perhaps the number of active VC firms shrunk as well? It's difficult to imagine how the pandemic (or another event) could prompt VC firms to suddenly leave the industry altogether: indeed, the data confirm that this was not the case.

Mind the... time trends

Comparing 2020 against previous years conveniently ignores that the VC market is subject to different financial dynamics and business conditions every year. In addition, we ignore multi-year trends that link the activity in 2020 to the achievements of previous years. These concerns can be somewhat mitigated: comparing 2020 only with the two previous years (instead of a longer period) reduces the risk of results being swayed by long-term shifts in the data. To capture any annual effects, we also tried measuring weekly data as a percentage of total annual activity. Conclusions do not change, however, so we stick with the more intuitive absolute figures.

The decrease in the number of investments was due to the significant reduction in the probability that (active) VC firms invest. There were significantly more VC firms investing in the market in the middle of 2020Q1 than at the same time in the two previous years. ▼

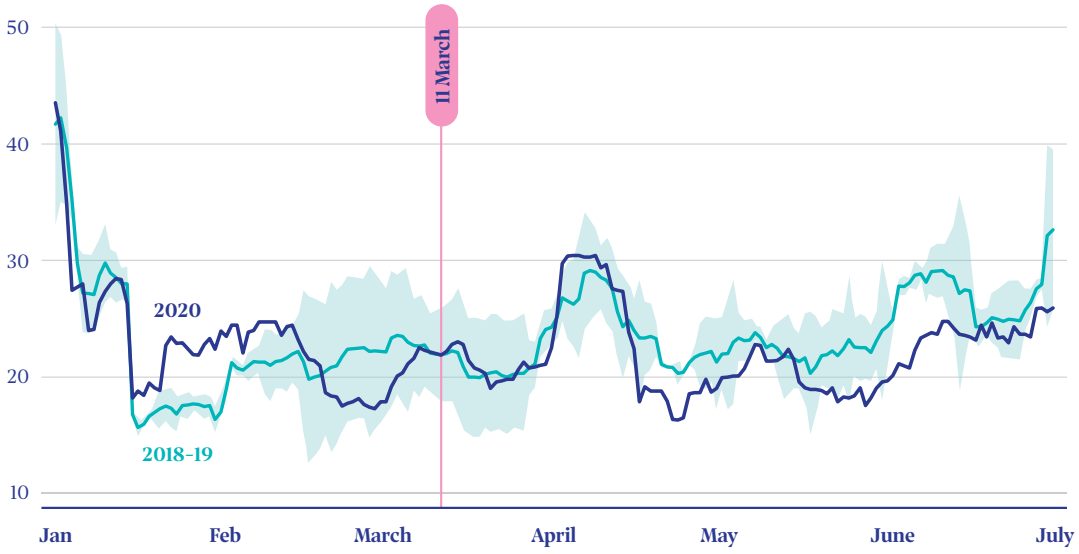
However, their number shrunk noticeably in mid-April 2020. In fact, the number of investing firms closely tracks the investment deals' trend.

Interestingly, we do not observe a comparable fall in the total volume of VC investments.

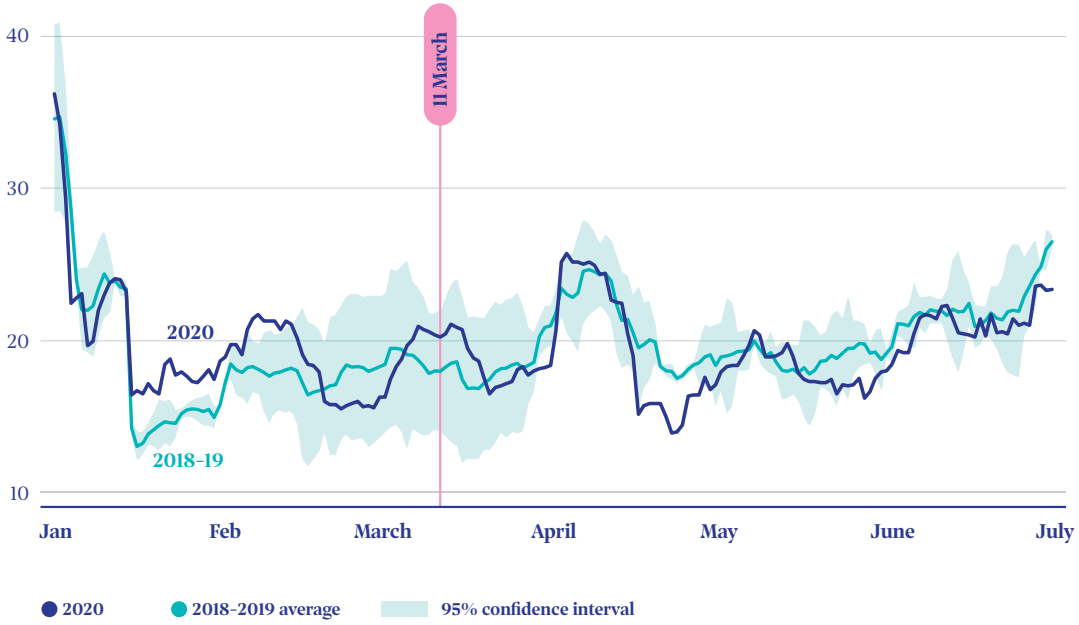
A guide to the graphs

The graphs show the VC industry's daily results. The solid green line indicates the average daily results in 2018 and 2019 while the transparent green area denotes their 95% confidence interval. Very intuitively, if the blue line, representing the 2020 evolution, is outside of the 2018-2019 results' confidence interval, then the respective outcome in 2020 was significantly different from the two years before. The vertical pink line marks the date on which the WHO announced that the coronavirus epidemic has turned into a fully-fledged global pandemic. ▶

Number of daily VC deals *(bi-weekly moving average)*

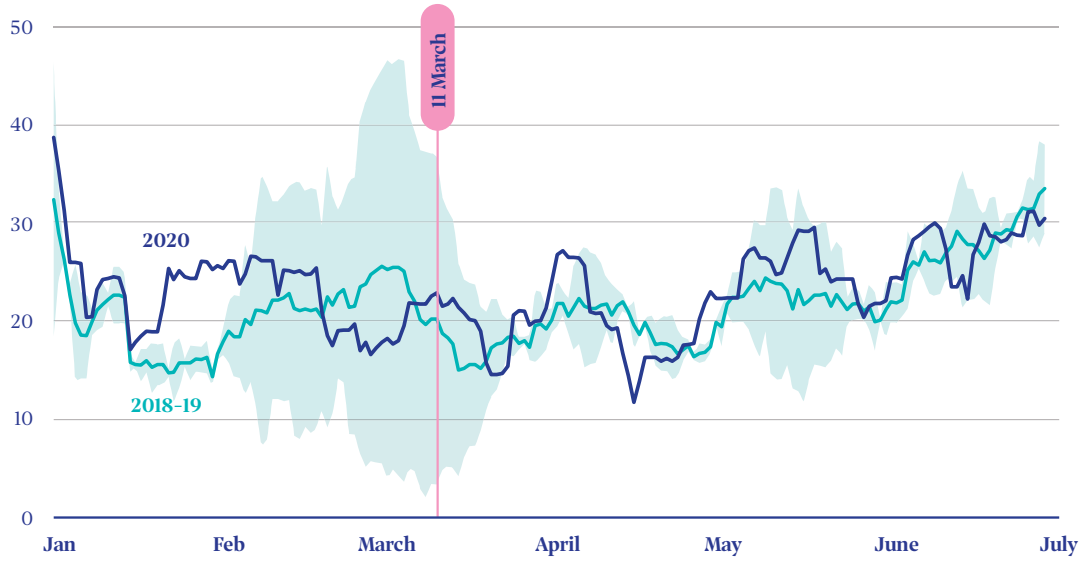


Number of investing firms per day *(bi-weekly moving average)*

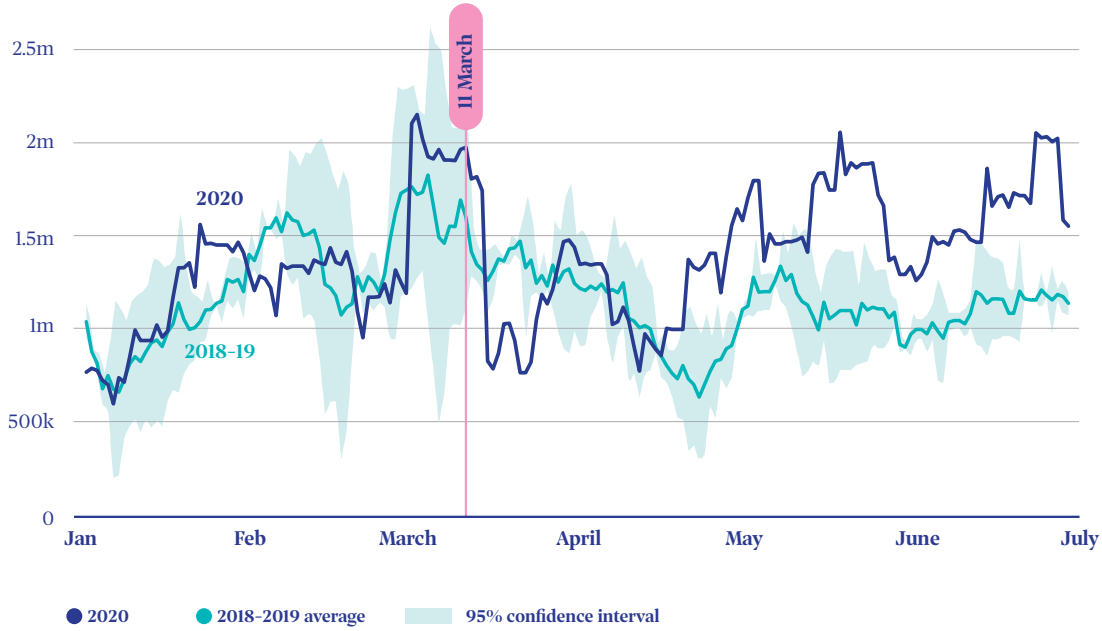


In fact, invested volumes up until the middle of 2020 are very similar to the two years before. Whether in the absence of the pandemic, volumes would have reached even higher levels, one can only speculate. It is certain, however, that total volumes did not experience a decrease compared to the past two years. If VC firms invested less, but volumes remained about the same, then all or some of the investment sizes must have increased. This was the case, on average, for initial investments (for the VC firm) from mid-April 2020 onward. ▼

Total daily VC volumes *(EUR M, bi-weekly moving average)*



Average daily initial VC volumes *(bi-weekly moving average)*



Mind the... raw data

Working with authentic high-frequency data is both a blessing and a curse: the raw data points that feed our analysis are quite jumpy, which makes it hard for important patterns to stand out. Therefore, we smooth our daily time series using a two-weeks moving average. This transformation helps us to better distinguish the underlying data trends, though similar conclusions could be obtained from the raw data as well.

> "Total VC volumes did not experience a decrease compared to the past two years."

Therefore, even though VC firms undertook less deals, those that did invest provided, on average, larger financing.

Interestingly, we do not find a similar trend in the case of follow-on funding. One possible reason for this is that VC firms specifically allocated extra funding to help new start-ups weather through the effects of the looming "black swan", without disregarding the traditional focus on business growth.

By the way, the pandemic did not only affect new investments, but old ones as well. The number of VC firms exiting their invested start-ups decreased, likely caused by the heightened market uncertainty and the significant restrictions affecting travel and, more generally, doing business during the first half of 2020.

Can we measure the impact of a black swan?

Comparing 2020 data against earlier years is easy, but using such analysis to quantify the impact of COVID-19 is much trickier. In order to quantify the changes in the VC industry due to the coronavirus crisis, we have to believe that, had VC firms not found themselves facing a global pandemic from the second quarter of 2020 onward, they would have behaved roughly like in 2018 and 2019.

For the sake of argument, suppose that our belief turns out to be true. We can then use a technique called difference-in-differences (DID), also diff-in-diff, to quantify the change in the VC industry in the three and a half months immediately following the announcement of the pandemic. ▶

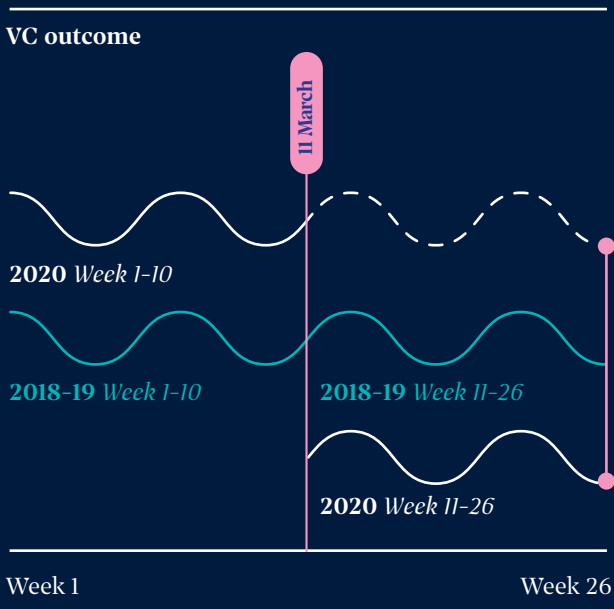
Difference-in-differences method

As opposed to the visual analysis presented earlier in the chapter, the DID is a rigorous econometric tool, which adds a layer of statistical robustness to our results.

The main idea is to take two groups – one affected by an event (treatment), the other not (control) – and compare them before and after the event in question. Unfortunately, there was no single group unaffected by the pandemic - it spread across the entire world. There might be, nevertheless, a work-around. Instead of dividing the VC industry into control and treatment groups, as is the usual practice, we divide it into two time groups – the year 2020 and the two years before – 2018 and 2019. We then introduce a cut-off date - March 11 in each respective year.

In order to detect any changes following the WHO announcement, we compare our two groups before and after the cut-off date. More specifically, we subtract the VC industry's results before March 11 2020 from its results after this date in 2020. This gives us the first difference in the difference-in-differences approach. Similarly, we subtract the average results of the VC industry before March 11 in 2018 and 2019 from its results after the same date in these two years, which gives us the second difference. Finally, to estimate the changes following the pandemic, we subtract the second difference from the first.

Appendix A goes into further detail about the DID method and sets up the formal econometric framework.



**The dashed line shows how the VC industry was expected to perform in the absence of a pandemic. We extrapolate this result by starting from the VC industry's level in the wake of the pandemic, and then applying the seasonal fluctuations observed in the two previous years. Subtracting the extrapolated trend from the realised outcome shows how the industry changed.*

The DID results[12] confirm all insights drawn from our descriptive analyses. The three-and-a-half-month period after the announcement of the pandemic in 2020 experienced a statistically significant:

13.6% decrease in the number of investments

22% decrease in the probability that VC firms make an investment

19.3% increase in the average amounts provided as initial investments[13]

43% decrease in the number of exited investments

What about disproportionate effects?

Did the pandemic disrupt the VC industry equally? The short answer is: pretty much. We can use an extension of the difference-in-differences method, called triple difference, to address this obvious follow-up question.

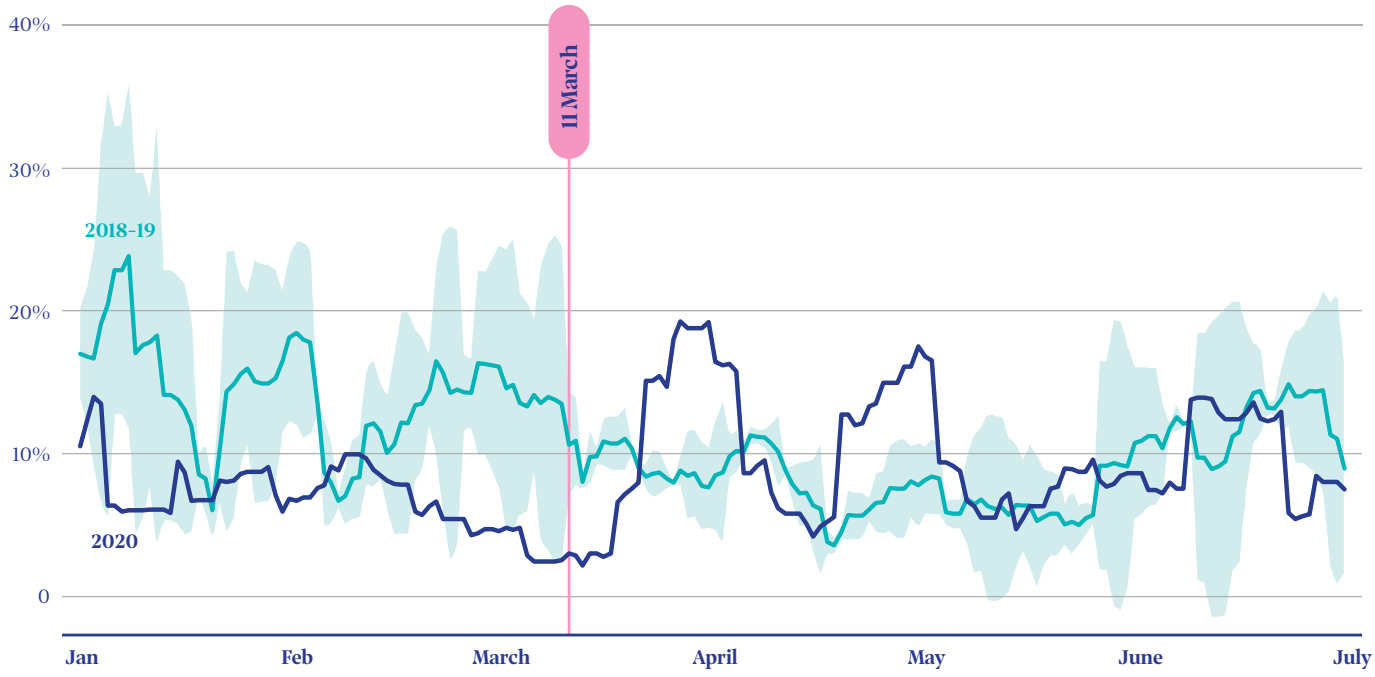
There is not much divergence across different sectors of the economy, stages of VC investment, ages of invested companies or other categories. Investigating numerous breakdowns with the triple difference approach does not lead to widespread disproportional results.

However, there are noteworthy exceptions. An important one concerns the healthcare industry, which performed much better than biotech, both in terms of number of deals and invested volumes.

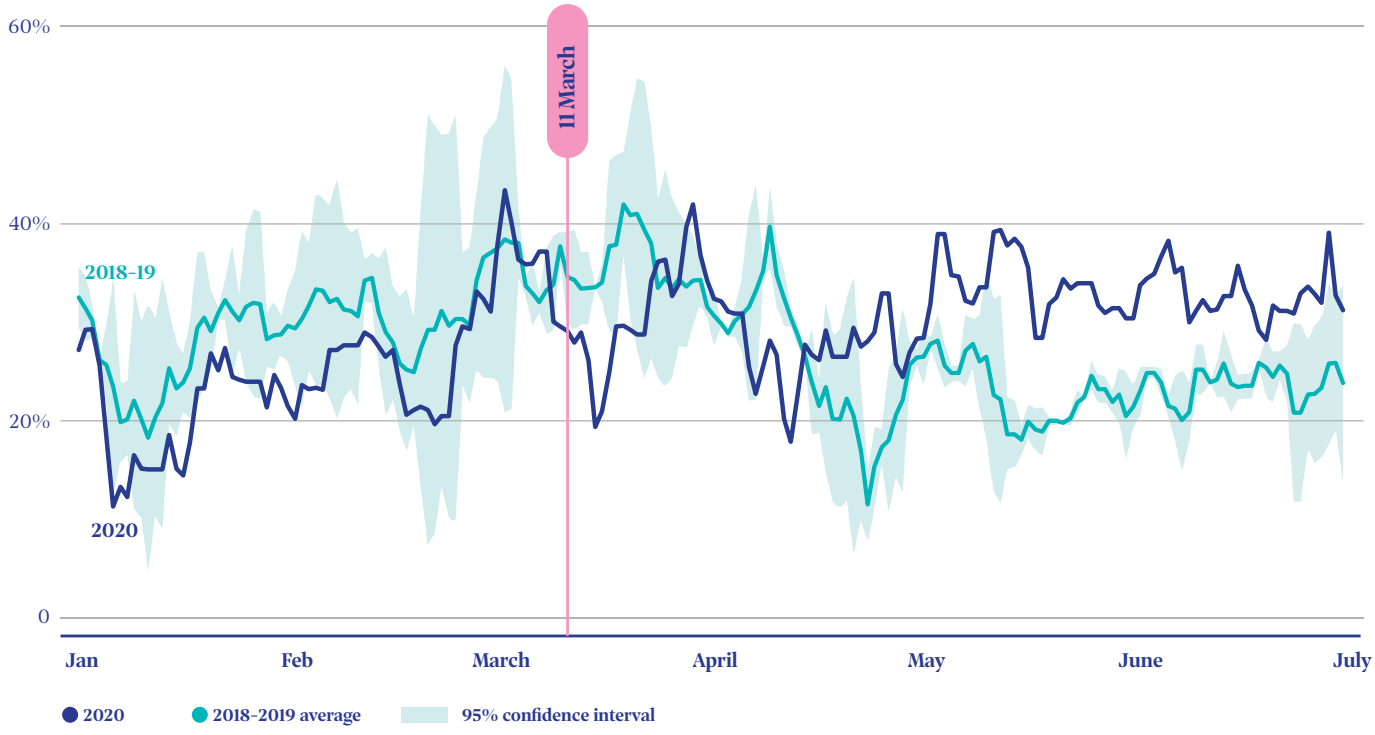
> “Many VC firms saw new opportunities or decided to further fund already existing ventures operating in the healthcare domain.”

[12]The complete estimates of our DID regressions can be consulted in Appendix A, Table 1.
[13]Note that we observe a significant increase only in average initial investments, not in the case of average follow-on investments.

Share of daily VC volumes invested in healthcare *(bi-weekly moving average)*



Share of average daily initial VC volumes *(bi-weekly moving average)*



In fact, by estimating our simple DID model only on VC investments made in healthcare companies, we note a significant 77% increase in total volumes invested after the onset of the pandemic.

This finding may not be surprising – amid a global pandemic, many VC firms saw new opportunities or decided to further fund already existing ventures operating in the healthcare domain.

Another exception relates to the different types of financing. In comparison to average initial volumes, follow-on average amounts decreased significantly. Perhaps counterintuitively, VC firms continued to bet on new ideas more than sustain already financed ones. This finding could find an explanation in conjunction to the one above – the rapidly changing global environment meant many new creative solutions were in need of fresh VC financing.

There are no other significant differences across the rest of the sectoral, age, amount or stage breakdowns. Even though the pandemic was correlated with a reduction in the number of deals and an increase in the average invested volumes, these effects were mostly equally distributed across the entire VC industry. Apart from the healthcare sector, which is an obvious "winner" in terms of new financing, the pandemic did not disproportionately affect other particular groups.

> "Apart from the "winner" healthcare sector, the pandemic's effects were mostly equally distributed across the entire VC industry."

Triple difference

The triple difference is an extension of the difference-in-difference approach and is, very simply, the difference between two difference-in-differences estimators. For example, in our set-up if we want to analyse how the pandemic affected the healthcare sector versus the services sector, we have to estimate the DID for both industries and then subtract one from the other. Read more about this approach in Appendix A.

Mind the... causal relationship

Despite our significant results, it's hard to claim that we correctly isolated the causal effect of the COVID-19 pandemic on the VC industry. Why? Because the industry might have undergone a number of transformational changes in the years 2018, 2019 and 2020 that, however coincidental, are unrelated to the COVID-19 pandemic. Granted, it's hard to figure out why these non-COVID-19 related changes impacted activity data only from the second quarter onwards. Nevertheless, we cannot rule out this eventuality, so our results can only point to the direction and magnitude of the correlation between VC activity and the WHO March 2020 announcement.

Synthetic DNA on demand

DNA Script

“Getting access to synthetic DNA is a real challenge for any life-science project. Our aim is to provide a tool that will allow life-science teams to manufacture the synthetic DNA they need for their project on-site in a matter of a few hours rather than several days,” explains Thomas Ybert, co-founder and CEO of DNA Script. The technology that the company has developed allows for a rapid, convenient way to access DNA on demand through SYNTAX, the world’s first benchtop DNA printer powered by enzymatic technology. In the context of a pandemic, DNA synthesis will be key in the development of any vaccine. “Imagine a new outbreak in a remote region, a new virus… With our instrument, teams could quickly provide the DNA needed to sequence the first genome of the virus, and access critical information within hours” adds Thomas.

Part 2

Passing the COVID-19 test: did lockdowns choke the VC deal flow?

Lockdowns brought considerable restrictions to mobility that, in turn, entailed significant socio-economic costs. This encouraged public authorities to be cautious about enforcing such measure. As a result, lockdowns have been uneven across Europe, with stark differences in their timing and geographical scope (e.g. national vs sub-national).[14]

The uneven geographical implementation of lockdowns across Europe provides a unique opportunity to evaluate the impact of COVID-19 on the European VC ecosystem. To make the most out of it, we need to carry out a sub-national analysis, mostly based on data at the level of NUTS-3 regions. However, since the absence of a lockdown does not imply the absence of other measures to mitigate the spread of the pandemic, it is important to consider that this analysis can only partially measure the effects of COVID-19 on the VC industry. In other words, we only look at the direct effects of lockdowns, not at the full-scale impact of COVID-19.

The goal of our analysis is to compare the investment activity of regions subjected to lockdowns (treatment group) against those that, during that time, did not experience a lockdown (control group). Unfortunately, such regions may not be comparable, for instance in terms of baseline VC activity, maturity of the local VC ecosystem and severity of COVID-19 on public health.

The uneven implementation of lockdowns across Europe

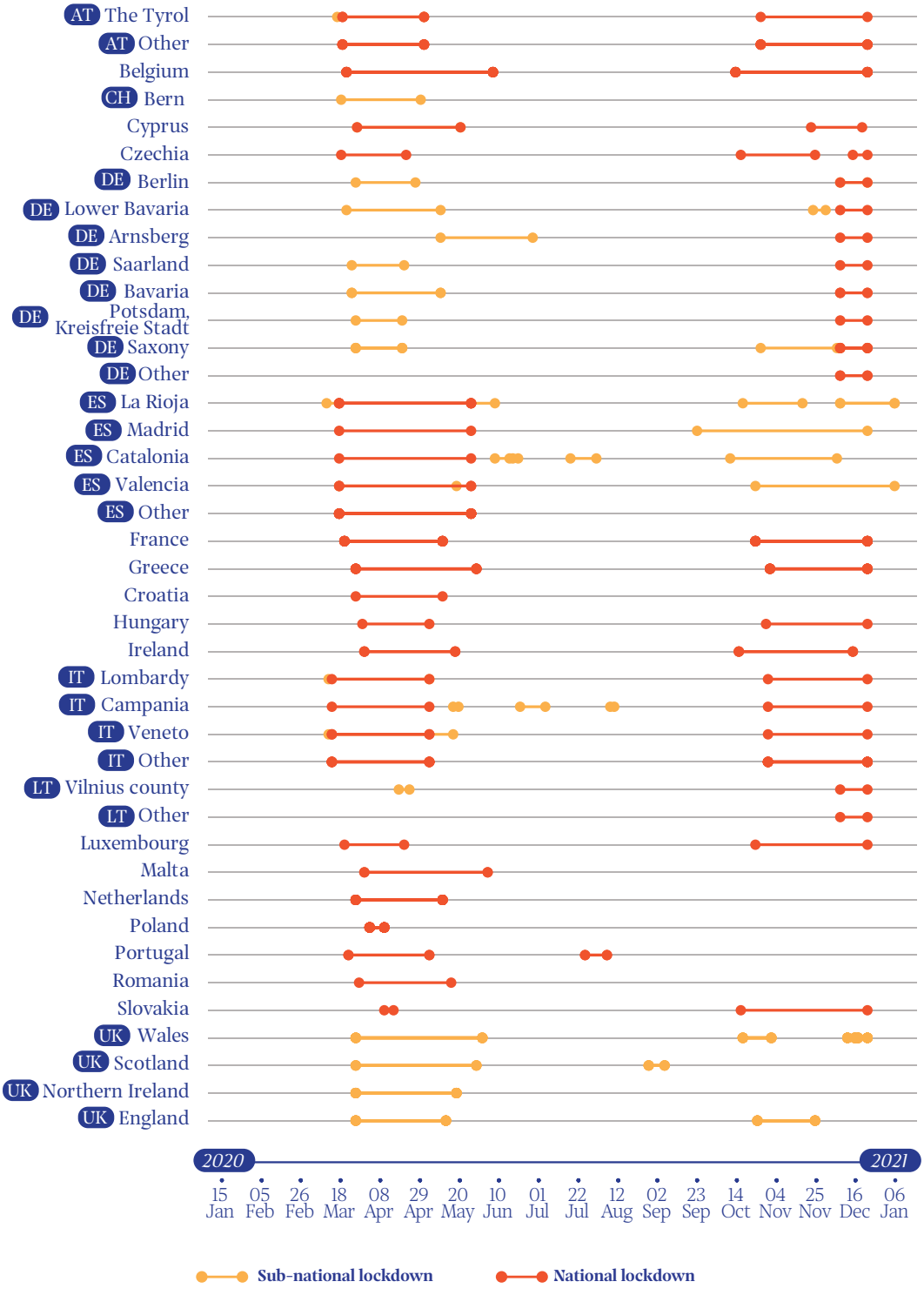
Based on national data from the Oxford COVID-19 Government Response Tracker[15] and sub-national information from the CoronaNet database,[16] 1,001 out of 1,387 NUTS-3 level regions in the EU27, UK, Norway and Switzerland experienced a period of either national or sub-national lockdown during the first half of 2020.[17]

While many of these restrictions were gradually lifted over the course of the summer, a second COVID-19 wave during the autumn months forced many governments to reintroduce them, such that by the end of the year, 1,258 out of 1,387 NUTS-3 level regions had experienced a period of lockdown at some point during 2020.

Note that due to the different data sources used in this chapter, we used here the NUTS 2016 classification scheme, as opposed to the NUTS 2021 classification introduced in Chapter 1.

[14]For instance, our analysis finds that the following countries did not implement a national lockdown in 2020: Bulgaria, Denmark, Estonia, Finland, Latvia, Norway, Sweden and Switzerland. Some of these, however, implemented regional lockdowns. Similarly, Germany did not have a national lockdown during the first half of 2020.
[15]Thomas Hale, Noam Angrist, Rafael Goldszmidt, Beatriz Kira, Anna Petherick, Toby Phillips, Samuel Webster, Emily Cameron-Blake, Laura Hallas, Saptarshi Majumdar, and Helen Tatlow (2021). A global panel database of pandemic policies (Oxford COVID-19 Government Response Tracker).
[16]Cheng, Cindy, Joan Barceló, Allison Hartnett, Robert Kubinec, and Luca Messerschmidt (2020). COVID-19 Government Response Event Dataset (CoronaNet v1.0).
[17]Of which, 171 experienced a lockdown exclusively at the sub-national level. Note: the five NUTS-3 level regions corresponding to the overseas territories of France were excluded from this calculation.

Regions under national/regional lockdown during 2020[18]



The Data

As we noted in Chapter 1, VC firms tend to be clustered around few hubs and regions. This leads to only 16.7% of all NUTS-3 level regions with some VC investor activity being used in our analysis. We also exclude 12 regions with no observed investor activity during 2020 and, finally, we set aside 25 treated regions that only experienced a lockdown during the second half of 2020.[19] We are left with 166 treated and 28 control NUTS-3 regions, hosting 619 and 134 VC firms respectively. Each region comes with its associated weekly activity data, summing up all activity for investors located in that region for a given week. Similarly to Part 1, we smooth weekly data to make it easier for data patterns to stand out.

[18]Source: Authors, based on Oxford COVID-19 Government Response Tracker and CoronaNet database.
[19]We plug these back in in some additional regressions, based on more sophisticated modelling. However, results remain largely unchanged.

How can we make sure that such regions are comparable, in order to measure the true effect of lockdowns? The answer lies, once more, in the difference-in-differences (DID) approach introduced in Part 1. By comparing the before-and-after changes in investment activity for treatment and control groups, we can estimate the average impact of COVID-19 lockdowns.

Now that our methods are outlined, let's check out the indicators we can use to measure the VC industry's activity. Three different measures paint a fuller picture of the change in behaviour of investors following the introduction of lockdowns:

- Number of VC investments
- Volume of VC investments (in EUR million)
- Breadth of VC investments: the physical distance between the VC firm's and start-up's headquarters (in km)[20]

> "The uneven geographical implementation of lockdowns across Europe provides a unique opportunity to evaluate the impact of COVID-19."

Mind the... parallel trend assumption

The DID approach relies on a key assumption, called parallel (or common) trend, which implies that control units simulate the growth trajectory of treated units in the absence of treatment. To make this assumption more plausible, we statistically "pair" (or match) each treated region with one or more control regions that, before the introduction of lockdowns, closely mirrored the treated region's investment activity, public health situation, demography etc.

Statistical matching comes in many forms and shapes: here, we implement an approach called ridge matching, which leads to a synthetic (artificial) control region that is then compared against its associated treated region. This artificial region is built from the weighted average of real control regions, where the "weight" represents how much that control region behaves similarly to the reference region under lockdown. We also test other types of statistical matching, but they all point to the same results.

The impact of lockdowns on the European VC industry

It's time to let the data speak. Remember: our DID regression approach is essentially a comparison between two groups. It compares the investor activity in a given week after the introduction of lockdown measures against the activity in unrestricted regions during the same week, removing any pre-existing difference in activity between the two groups. Therefore, we can picture our results as two lines – one for treated and one for control regions – tracing the average activity at each and every week before/after lockdown, and associated error bands.

It's easy to see that, in the weeks before lockdowns were introduced, the two groups were just about on the same investment activity path. However, shortly after the announcement, the two lines start to diverge and, about two months later, such divergence becomes statistically significant: VC firms in regions under lockdown signed 13% fewer deals than control investors located in regions with no restrictions to mobility. The difference grows to about 20% by the ninth post-lockdown week, but starts shrinking again after the tenth post-lockdown week. ▶

Why is it that we are only able to see statistically significant differences between the two groups seven to ten weeks after the introduction of lockdowns? Three hypotheses seem particularly plausible.

First, VC firms are likely to have, at any point during the year, a robust pipeline of already scrutinised VC deals on their table. Even under lockdown, it may have been possible to finalise such deals virtually.

[20]Note: calculated as the great-circle distance between two geographical coordinates. Physical distance is not necessarily travelled: contracting might happen virtually, with no need to travel between headquarters.

Once the pipeline is exhausted, however, sourcing new deals might have been especially hard, for instance due to the cancellation of many events and/or other gathering opportunities for the VC community during 2020.

> "VC firms in regions under lockdown operated at 15 to 20% lower activity levels than they could have had in the absence of such measure."

Second, VC firms may have intentionally chosen to exploit the "grace" period offered by the lifting of the first lockdown measures to reorganise themselves, revise and adapt their processes to better fit a hybrid virtual/physical work environment. Such reorganisation might have had short-term negative effects on activity.

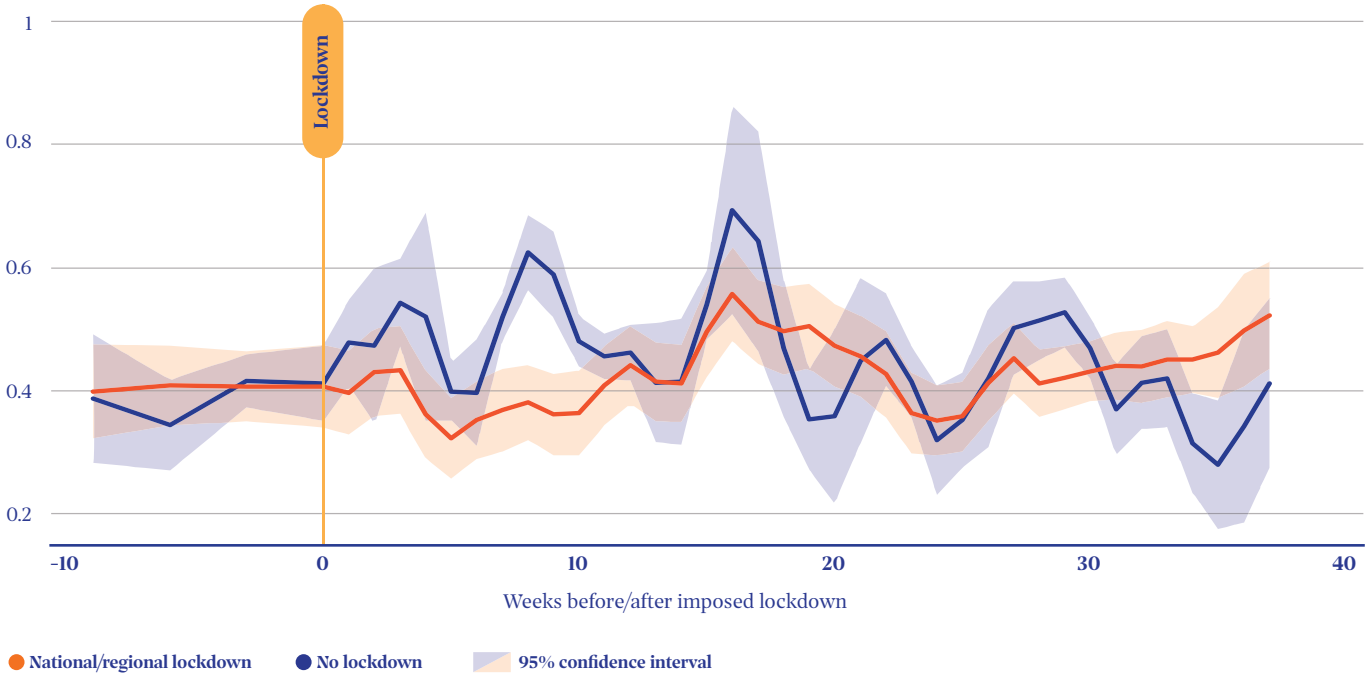
Third, we could be witnessing "lockdown fatigue": the stressful experience of strict lockdowns might have proven an incentive for VC teams in affected regions to exploit the "grace" period and take more time off work, in turn leading to a temporary reduction in output.

More than two and a half months after lockdowns had been introduced, the change in activity of VC firms in constrained regions is statistically undistinguishable from that in control regions. The impressive recovery overlaps and is probably partially explained by the gradual lifting of restrictions in the lead-up to summer 2020.[21]

A guide to the graphs

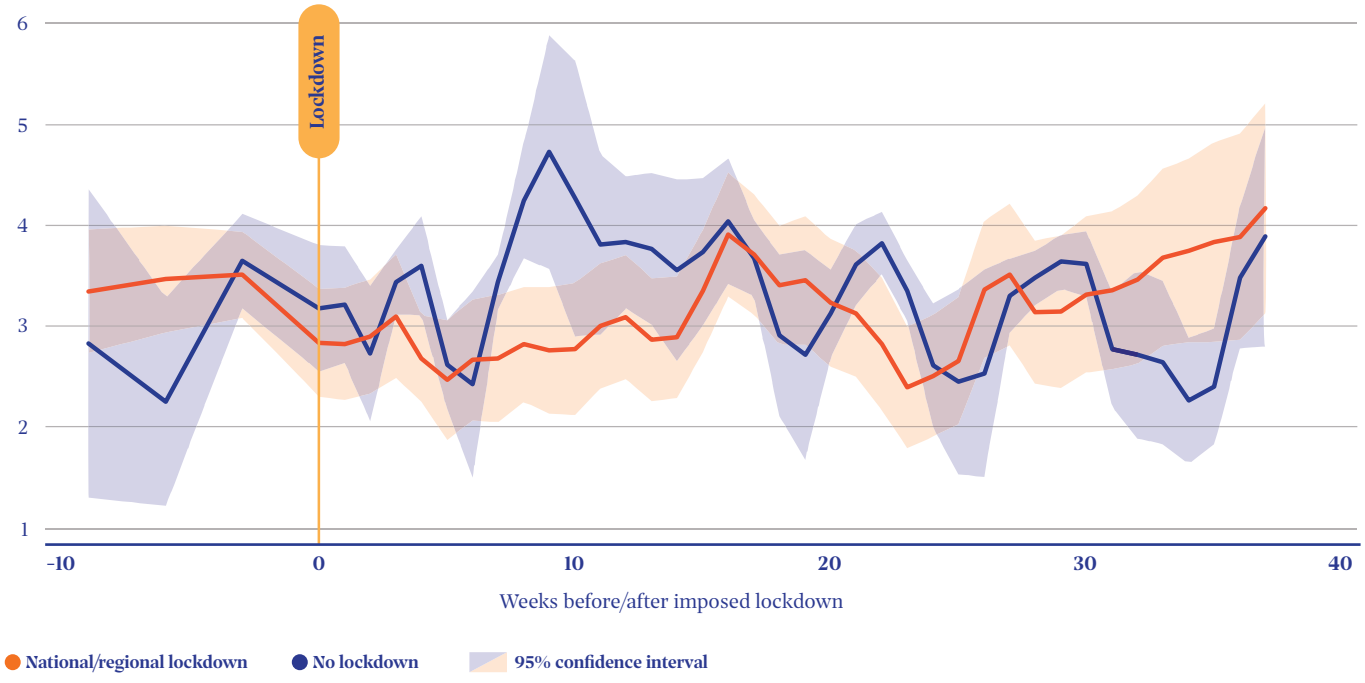
A quick explainer on how to read the next three charts. The orange line and error bands trace the expected logarithm of a given VC outcome. NUTS-3 regions experiencing a lockdown. The blue line represents the same measure, but for the case of control regions. Such logarithmic representation allows interpreting the distance between the two groups as percentage difference.

Expected weekly number of investments *(in log), by lockdown status*



[21]Of the 166 treated regions with VC investor activity, 164 lifted existing lockdown measures during the period between April 9th and July 10th 2020, with most deconfinement measures occurring during the period between May 4th and June 15th 2020, and on average about 8 weeks after the announcement of the first lockdown.

Expected weekly investment volumes *(in log), by lockdown status*



Mind the... staggered lockdowns

The lockdown announcement window in our dataset spans across 11 weeks, from week 8 to week 19 of 2020, with 97% of stay-at-home orders already in place by week 13.[22] To align timelines, we center our data around the lockdown cut-off week, so that week "0" becomes the week in which lockdown measures were introduced, week "-1" is the previous week, week "+1" is the following week, etc.

However, there might be more behind this recovery: two thirds of regions that initially experienced a reopening later underwent a second lockdown, due to COVID-19 cases resurfacing across Europe.

Second lockdowns took place, on average, 33 weeks after the first one.[23] Yet, they were not followed by a significant dip in activity for constrained regions. In fact, by then these were investing at a higher pace than control regions – though this may be spurious: we don't find the same result for activity volumes.

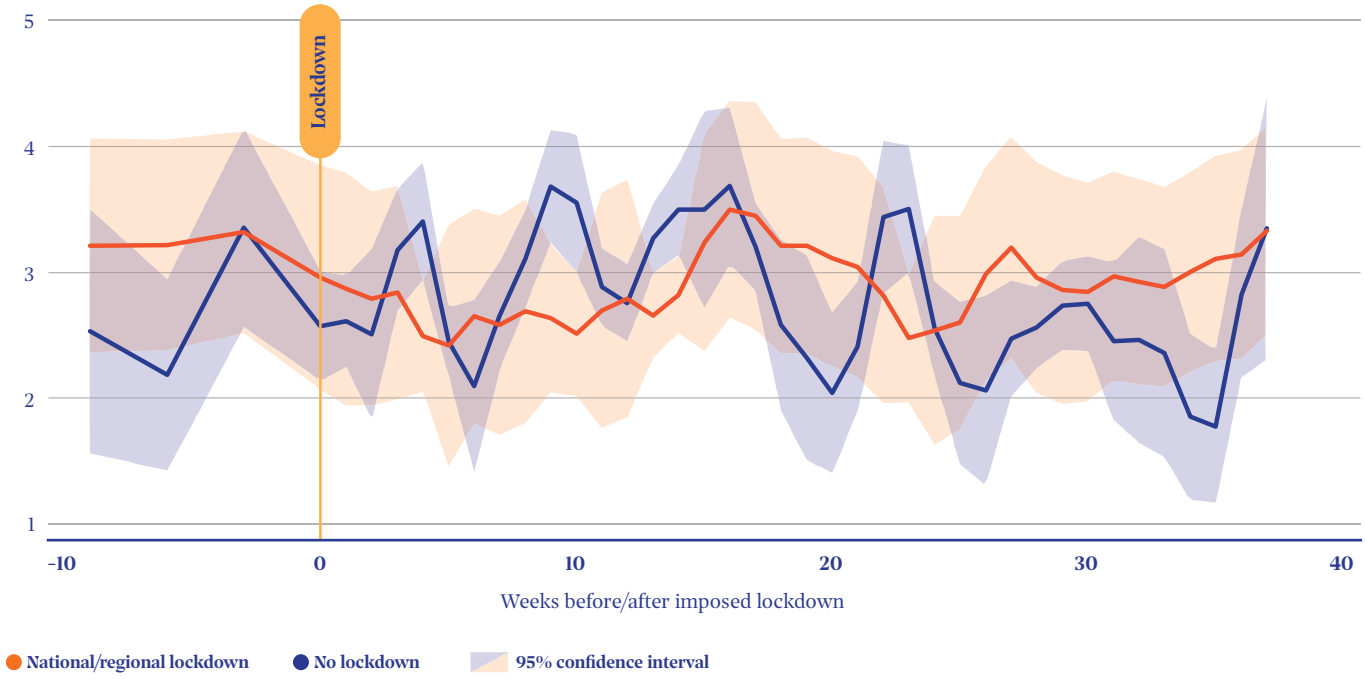
All in all, the data point to the measureable harm of the initial 2020 lockdowns to VC activity. For about a month, VC firms in regions under lockdown operated at 15 to 20% lower activity levels than they could have had in the absence of such measure. Luckily, the effect did not last long.

As the summer of 2020 began, VC firms under lockdown had adapted to the new normal: not only they were back on track, but they had also developed some type of immunity against new lockdown waves.

Looking at alternative measures of VC investor activity helps us to add more context and colour to our initial findings. The chart above compares (log) VC investment volumes between the two regions before/after the introduction of lockdown measures. As with the number of VC investments, the two groups behaved roughly similarly before the introduction of lockdowns. After restrictions were announced, average weekly investment volumes remained relatively stable for VC firms affected by national/regional lockdown, but began increasing in control regions. ▲

[22]That is, the week between Monday 23rd March 2020 to Sunday 29th March 2020.
[23]Specifically, for the 109 out of 164 regions with VC investor activity that exited and re-entered a (sub-)national lockdown did so anywhere between 10 and 38 weeks after the first announcement of the measure, with most regions re-entering lockdown between 29 and 33 weeks after the first one.

Expected geographical span of weekly investments *(in log), by lockdown status*



The differences between the two sets of regions is once more significant only during the eighth and tenth week after the appearance of lockdowns. During this period, the distance between the two groups is large: 143% on average. The weekly gap quickly fades away thereafter, and does not reappear with the onset of the second wave of lockdowns, confirming our earlier impression that VC firms facing initial mobility restrictions subsequently managed to adapt to the new normal.

How significant is a 143% difference? If we compare these figures with their expected weekly VC volumes, regions under lockdown were missing, on average, about half a million Euros worth of weekly investments compared to what could have happened without lockdown. This sums up to about EUR 250m worth of VC activity lost due to lockdowns during those three weeks.

Distance plays a key role in the VC industry. Whether geographical, cultural and/or institutional, distance usually translates into additional risk and threatens to lower investors' appetite. Did lockdowns further limit the geographical span of VC firms' investments? Not really: the chart above paints a rather blurred picture. ▲

> "As the summer of 2020 began, VC firms under lockdown had adapted to the new normal."

Mind the... overlapping confidence bands

If you've ever looked at two groups' outcomes with overlapping error bands and thought "That must mean that the two groups aren't significantly different", then think again: this happens to be a common statistical misconception. To see why, check Appendix B. Here, it suffices to say that this issue can be solved by adjusting error bands accordingly. Our charts do just that: they are consistent with statistically significant differences at the 95% confidence level.

In truth, there are some divergences in the average distance following the introduction of lockdowns. For two weeks – the ninth and tenth post-lockdown week – such differences are even significant and amount to 100% fewer "travelled" kilometres for VC firms in regions under lockdown. However, the high volatility of this measure and the large error bands make it unlikely that lockdowns truly affected the investment behaviour towards start-ups that are located far away from the VC firms' premises.

Two theories can explain the almost complete lack of effects on the geographical span of investments, even though lockdown measures were specifically aimed at curbing mobility. For one, it is possible that VC firms under lockdown successfully replaced with equivalent virtual solutions all forms of physical interaction with start-up teams, including in the more delicate phases of the deal flow like the due-diligence process. Otherwise, it may be that widespread inbound travel restrictions – affecting treated and control regions in roughly equal amounts – captured most of the reduction in the geographical span of investments, leading to no additional effect directly attributable to lockdowns.

> "Lockdowns did not further limit the geographical span of VC firms' investments"

Did the VC industry suffer from long COVID?

So far, we measured differences in VC activity due to lockdowns one week at a time. That's a bit like trying to comment the 100 metres at the Summer Olympics by looking at how fast runners are at every second of the race: however insightful, this won't directly point out who won the race.

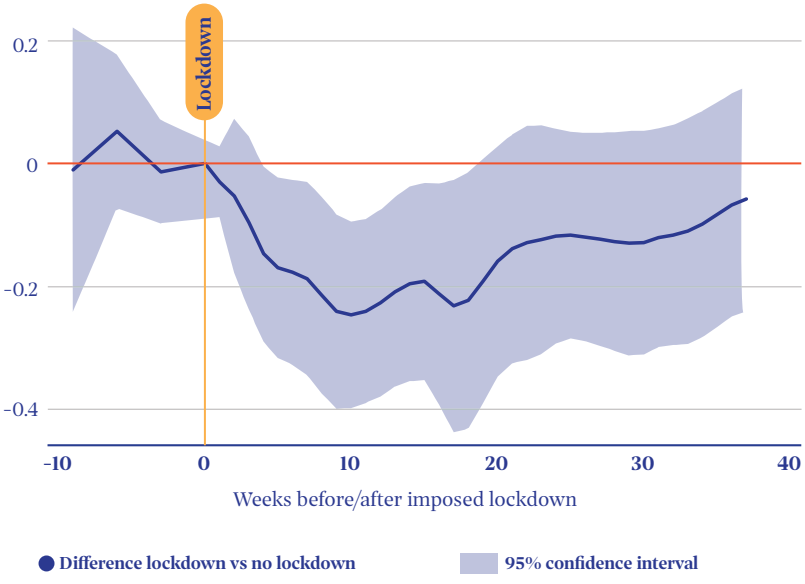
Similarly, we may be curious to know whether towards the end of 2020, VC firms that experienced a strict lockdown managed to recover from the activity gap accumulated during the 7th and 10th post-lockdown week and catch up with their no-lockdown benchmark.

Fuelled by the activity gap in the "dark month" between the seventh and tenth post-lockdown week, the distance between the two groups peaked around the 10th post-lockdown week. It then started a steady climb towards zero from the 18th post-lock-down week onwards.

A guide to the graphs

These new charts track how the average weekly activity evolved as time (and lockdowns) passed by. Here we focus on absolute values (instead of logarithms), and we plot directly the difference between the two groups. What matters is whether the error band for such difference crosses the zero line for a given week. If it does, we can conclude that, on average, between the start of the lockdown until that specific week VC firms in treated regions invested at a similar rate than VC firms in regions without lockdowns.

Difference in expected activity (nr. of investments)
since the first lockdown, updated each week



If the average VC firm facing one or more lockdowns and its alter ego from a different universe with no lockdowns were to meet by the end of 2020, they might find themselves with roughly the same activity rate, though with drastically different stories on how they achieved it.

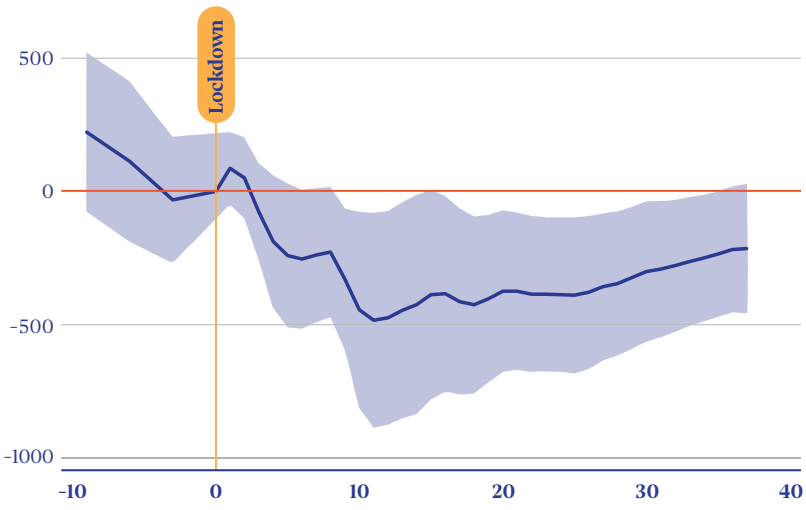
Playing catch-up with average invested volumes probably felt trickier for the typical VC firm in a lockdown region. Despite the distance between the groups peaking around the 10th post-lockdown week – similarly to activity rates – and steadily shrinking ever since, the gap in volumes lingered for much longer, saved by a year-end uptick that just about made the race statistically even. ▶

Finally, while the average distance covered by investments does diverge between groups, it never becomes significantly negative throughout the year. The year 2020 might have taught the VC industry that physical distance is not the fundamental hurdle they could have once thought. ▶

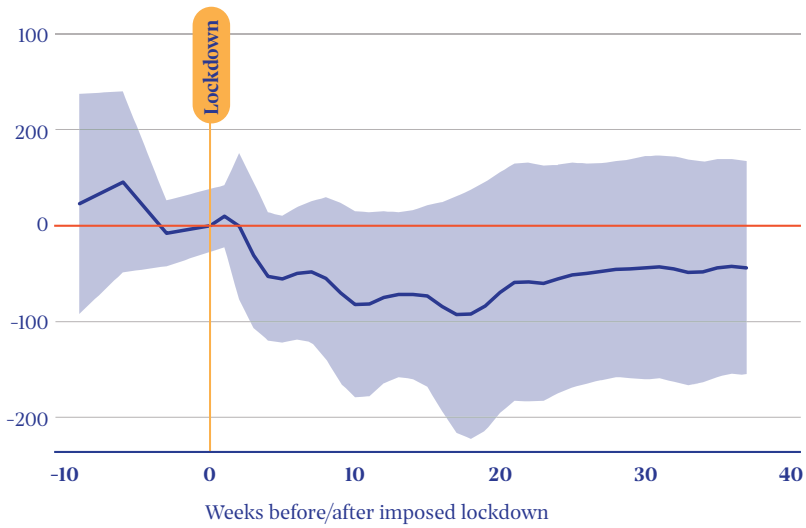
In conclusion, no: the VC industry did not experience a case of long COVID. Despite the symptoms lingering for quite a while during 2020.

> “The VC industry did not experience a case of long COVID, despite symptoms lingering for a while in 2020.”

Difference in expected activity (volumes, in EUR k)
since the first lockdown, updated each week

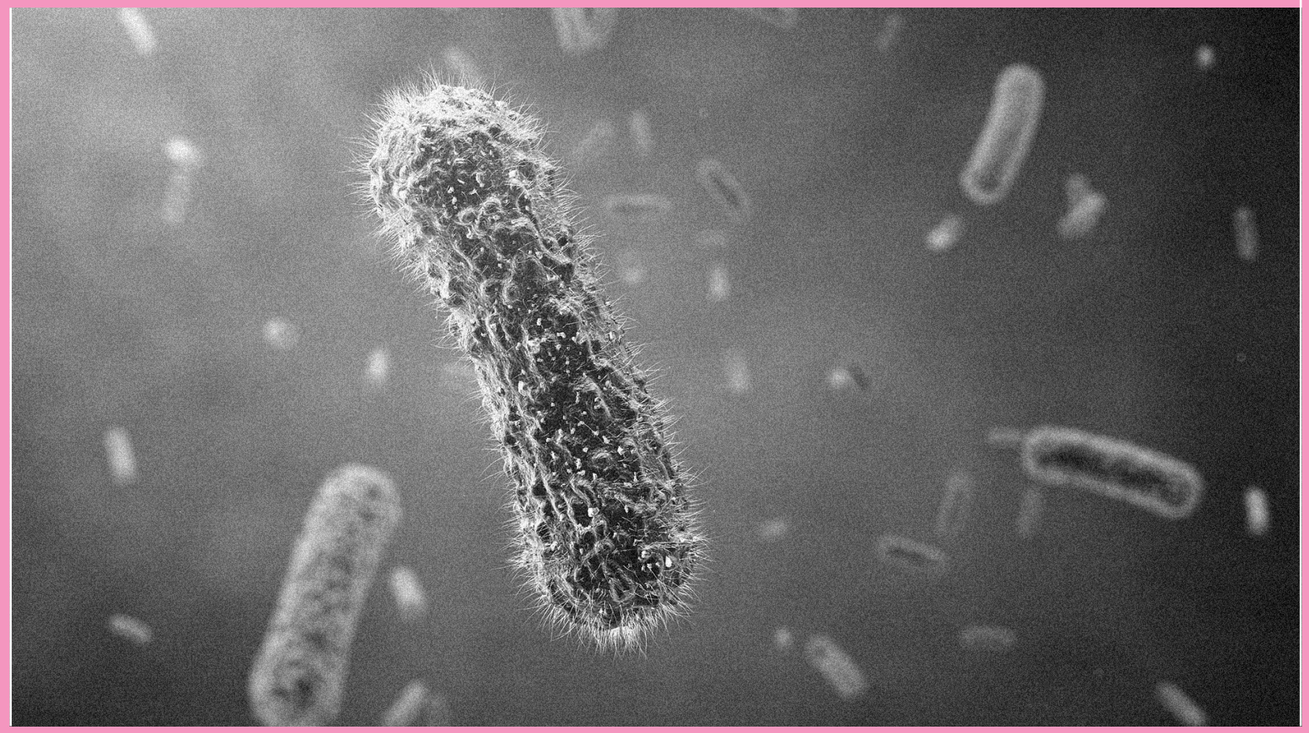


Difference in expected activity (geographical span, in km)
since the first lockdown, updated each week



Union Therapeutics

Niclosamide against COVID-19



What's interesting is that niclosamide works on the host cell, not the virus, so it's difficult for the virus to develop resistance" says Rasmus Toft-Kehler, co-founder of UNION, a Danish bio-pharmaceutical company dedicated to the discovery and development of novel medicines in inflammatory and infectious diseases. In 2020, when COVID hit and studies pointed to niclosamide as the most potent FDA-approved inhibitor of SARS-Cov-2, UNION was able to quickly focus its niclosamide research into a treatment for COVID-19 in collaboration with Institut Pasteur Korea. "This could be the perfect stockpiling product and can be easily scaled to cover all of Europe" adds Rasmus, "ultimately this can help to avoid lockdowns and the economic disasters we've seen."

Appendices

Appendix A

Difference-in-differences methodology

Formally, the DID method can be summarised in an equation:

$$Impact_{Covid-19} = (\bar{y}_{2020,P2} - \bar{y}_{2020,P1}) - (\bar{y}_{2018-19,P2} - \bar{y}_{2018-19,P1})$$

Equation 1

where y is some average VC outcome, such as the number of VC deals or invested volumes and the subscripts P1 and P2 denote the two periods – before and after March 11 in the respective year. In a regression setting, the econometric model looks like this:

$$y = \alpha + \beta P + \gamma G + \delta(P \times G) + [\theta_i X_i + \ldots + \theta_n X_n] + \varepsilon$$

Equation 2

where y is the outcome of interest, P is a dummy variable denoting the period, G is a dummy variable denoting the group and $[X_i \ldots X_n]$ is a vector of control variables. Most importantly, δ denotes the effect of the pandemic.

Put simply, the DID estimates the change in the VC industry before and after the pandemic and subtracts from it the change (if any) between the same two periods observed in the previous two years. Estimating both differences allows us to evaluate correctly any changes that transpired because this approach takes into account potential fluctuations – both seasonal as well as annual.

For example, imagine that usually the second quarter of the year is always weaker in terms of VC activity than the first one. If we had simply compared the two quarters, we would have (incorrectly) concluded that the pandemic caused a decrease in VC activity even though this decrease was caused by usual seasonal trends. By subtracting from the first difference the same difference but for the two previous years, even if the second quarter is usually weaker than the first, the estimated impact would absorb this and would measure only residual difference on top of the seasonal one.

Similarly, imagine that the VC industry was on a decreasing growth trajectory in 2020. If we had simply compared 2020Q2 to the average of 2018Q2 and 2019Q2, we would have again incorrectly concluded that the pandemic caused a decrease in VC activity even though this decrease was caused by an annual trend unrelated from the coronavirus. However, we would have missed the fact that in the first quarter of 2020, the VC results were actually stronger than before. By subtracting the first from the second quarter in 2020 we take into account the general level of the industry in 2020. Therefore, in order to estimate correctly any changes arising after the COVID-19 pandemic we need to account for seasonal as well as annual trends through the difference-in-differences approach.

Table 1 shows the estimates of our main regression models.

Table 1: DID regression results

Variable	Number of investments	Probability of active firms investing	Average initial investments	Number of exited investments
	Poisson	**Fixed effects Logit**	**Fixed effects OLS**	**Poisson**
	(1)	(2)	(3)	(4)
Year 2020	0.0905†	-0.210***	-0.147	-0.349†
	(1.83)	(-3.80)	(-1.63)	(-1.83)
Second quarter	0.877***	0.934***	0.0896	0.547***
	(18.11)	(11.16)	(0.65)	(6.24)
Year 2020 X Second quarter	-0.136*	-0.221*	0.193†	-0.430†
	(-2.50)	(-3.23)	(1.81)	(-1.89)
Week 4	0.0946***	0.247**	0.152	-0.433
	(3.51)	(2.85)	(1.11)	(-1.43)
Week 6	0.256***	0.414***	0.0773	-0.336***
	(5.54)	(4.89)	(0.53)	(-3.98)
Week 8	0.141	0.309***	0.196	-0.822***
	(1.45)	(3.62)	(1.32)	(-4.77)
Week 10	0.231***	0.405***	-0.0482	-0.248†
	(3.82)	(4.79)	(-0.36)	(-1.74)
Week 12	-0.625***	-0.498***	-0.153	-1.113***
	(-9.89)	(-6.66)	(-1.28)	(-7.85)
Week 14	-0.356***	-0.381***	0.0335	-0.508†
	(-7.37)	(-5.20)	(0.31)	(-1.82)
Week 16	-0.742***	-0.686***	-0.0949	-1.407***
	(-12.62)	(-8.96)	(-0.88)	(-9.04)
Week 18	-0.545***	-0.398***	0.0835	-0.974***
	(-13.34)	(-5.45)	(0.77)	(-4.00)
Week 20	-0.626***	-0.581***	-0.0395	-1.113***
	(-10.20)	(-7.77)	(-0.36)	(-3.75)
Week 22	-0.526***	-0.472***	-0.0425	-0.773**
	(-11.52)	(-6.44)	(-0.39)	(-2.67)
Week 24	-0.477***	-0.365***	-0.0836	-0.820**
	(-10.88)	(-5.08)	(-0.76)	(-3.28)
Number of obs.	39	38093	2434	39

Note: † 0.10 * 0.05 ** 0.01 *** 0.001; robust std errors in brackets;[24] number of observations vary according to the data structure analysed: (1) & (4) bi-weekly time series, (2) full bi-weekly VC firm panel, (3) intermittent bi-weekly VC firm panel.

[24] The logistic regression does not allow for robust standard errors.

An extension of the DID estimator is the triple difference estimator. It is, very simply, the difference between two difference-in-differences estimators. More formally, it can be computed via the following equation:

$$Impact_{Covid-19,Group\ B} = \left[\left(\bar{y}_{2020,B,P2} - \bar{y}_{2020,B,P1}\right) - \left(\bar{y}_{2018-19,B,P2} - \bar{y}_{2018-19,B,P1}\right)\right] - \left[\left(\bar{y}_{2020,A,P2} - \bar{y}_{2020,A,P1}\right) - \left(\bar{y}_{2018-19,A,P2} - \bar{y}_{2018-19,A,P1}\right)\right]$$

Equation 3

where the subscripts A and B denote two different groups. Equation 3 demonstrates that to find an event's impact in a specific population group, we need to take the same quantities as in Equation 1 but for two separate groups and subtract them from one another.

[25] Austin, P.C. and Hux, J.E. (2002). A brief note on overlapping confidence intervals. Journal of vascular surgery, 36(1), pp.194-195.

Appendix B

Statistically significant differences vs overlapping error bands

How is it that, for a given confidence level, the averages of two groups are statistically significantly different, yet their confidence bands may still overlap? Austin and Hux (2002)[25] explain it this way: "[t]his is because when one compares two means, the probability that one mean would lie in the upper 2.5th percentile of that means sampling distribution, while the other simultaneously lies in the lower 2.5th percentile of its sampling distribution, is substantially less than 5%. Hence, despite having overlapping 95% confidence intervals, one can reject the null hypothesis with a P value that is substantially less than 5%." This adjustment can be tangible: under typical conditions, to correctly represent a 95% significant difference, error bands at the 83% confidence level may be already sufficient.

Brought to you by...

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In lockdown, his cleaning supplies cabinet grew exponentially

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Under lockdown, he tested 16 different recipes for homemade pizza dough

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During lockdown, she designed her signature cocktail

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During lockdown, he heroically resisted posting any pictures of homemade bread on social media

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