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Financing EU Health Innovation: the role of Venture Capital

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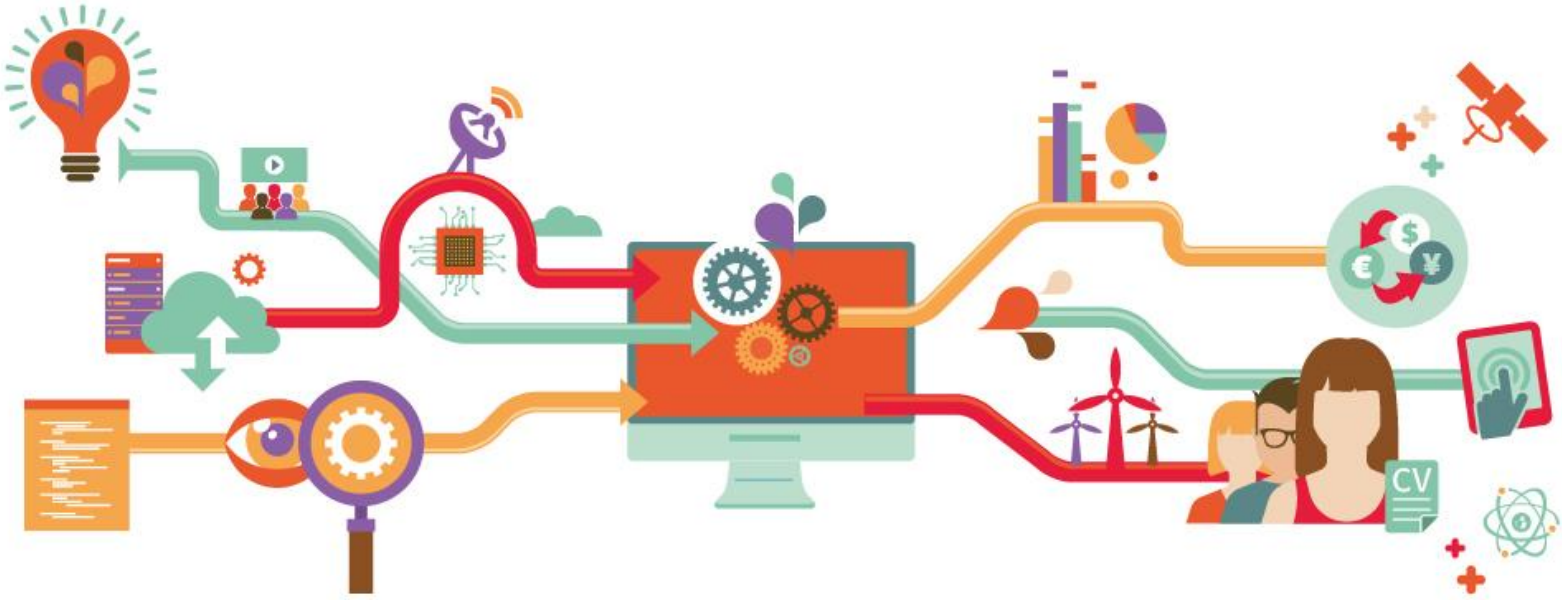

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Abstract

The EU is challenged by a persistent leadership gap in the global health innovation landscape, with the US leading in corporate health innovation and venture capital (VC) funding. The EU health innovation landscape is more concentrated in older "incumbent leading firms," while the US has a more dynamic landscape with higher R&D growth rates. Financing constraints are highly relevant in the health sector, particularly for startups and scale-ups with risky breakthrough ideas and technologies. The EU-US gap in dynamic innovative performance in health may be partly due to differences in access to risk finance, particularly venture capital.

This paper analyzes trends in VC financing for health-related innovations in Europe compared to the US, using data from Dealroom. The results show that the weakness of the European health VC market continues to hold in the early and late stages, where less progress seems to have been made. Some of the main findings include the following: the EU is lagging behind the US in the number of health VC deals, with a larger gap in late-stage deals; European deal sizes are below the US, with a larger gap in late-stage deals, the EU has a lower occurrence of co-investment deals, which does not help reduce the gap in health VC deals. Overall, the European health VC market is particularly missing larger-sized investors (investment funds) with late-stage deals. To address this gap, policy attention is needed to identify and reduce barriers for European health VC investors to grow to a critical scale and engage in a higher number and larger-sized deals. All in all, Europe should further develop and strengthen its strongest asset, i.e., its Open Single Market, reducing the fragmentation in flows of venture capital, reaching a truly single European Venture Capital market. For an EU open strategic autonomy industrial policy for health, an open single market for health remains the critical instrument to further develop and monitor.

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Executive summary

In the global corporate health innovation landscape, the EU is challenged by a persistent leadership of the US, with US firms dominating with over half of global corporate investment in health-related R&D, as highlighted in the 2023 EU Industrial R&D Investment Scoreboard. Moreover, the EU health innovation landscape is more concentrated in older "incumbent leading firms. In contrast, in the US, new health firms are less impeded than their EU counterparts to grow fast and achieve leading innovator status, and to thus challenge incumbents. This matters because such bigger Schumpeterian "creative destruction" in the US health innovation landscape correlates with a more dynamic, contestable landscape with higher R&D growth rates than the EU, fortifying their world R&D leadership in this sector.

Financing constraints on innovation are highly relevant in the health sector. They are particularly critical for the growth and scaling up of startups with risky breakthrough ideas and technologies. Differences in access to risk finance between EU and US health innovators, particularly access to venture capital for startups and particularly scaleups, may help to explain differences in the EU-US health innovation dynamics of their health innovation landscapes.

To better understand these financial constraints, we analyse trends in venture capital financing for health-related innovations in Europe compared to the US. The aim is to shed light on differences in venture capital financing and the European-US gap in dynamic innovative performance in health in the EU Industrial R&D Investment Scoreboard.

To this end, we compare European and US VC funding of health deals, using data from Dealroom. To test any differences in Schumpeterian "creative destruction" of leading positions in the health innovation landscape, we consider not only deals in the seed financing stage, but also in later stages of more relevance for the scaling-up of startups. We also characterize by type and size, the VC investors for European deals at the various stages of funding, compared to the US.

Taking into account the limitations of the Dealroom data, our main results can be summarized as follows:

Although **Health** is the largest **VC sector** in Europe, it lags behind the US in yearly number of health VC deals. The US, as global leader in hosting VC deals, is also strongly specialized in health VC deals (*i.e.*, its share of world VC deals is larger in health than in other sectors), consistent with its global leadership in corporate health innovation.

Although the **growth rate** in the number of VC deals in the last decade has been higher in Europe than in the US, allowing for some catching up, the gap still remains large. The **yearly VC deal volumes** in Europe remain far below the US, illustrating the less mature stage of the European health VC market.

Biotechnology startups account for almost half of Health VC deals in Europe. The EU's position in Deep Tech (most notably Medical Equipment) and AI/BigData/MachineLearning for health is surprising. Although these areas still represented a small share of all VC health deals in 2020, the gap with the US is less than in other health technology areas. In these sectors, Europe has managed to almost catch up with the US, at least in terms of annual numbers of deals.

With a higher yearly average growth rate in number of **seed stage** deals, Europe managed to catch up with the US. It nevertheless still faces a substantial gap also in this stage, with Europe representing only about 60% of equivalent US deals. Nevertheless, this is a much smaller gap compared to late stage deals.

Although Europe has witnessed also for **late stage** deals a positive yearly growth rate, this growth is much more modest compared to other funding stages. Yet, it is this late stage where Europe most lags the US: the number of European late stage deals represent only one quarter of equivalent US deals.

European **deal sizes** are below the US and this holds for every funding stage. However, the gaps are larger the later the stage: for late stage deals, the average deal size for Europe is somewhat less than half the US one. In terms of trends in deal sizes, the gap in deal size of Europe relative to the US has improved substantially for seed deals, but has widened for early and late stage.

In Europe there were fewer deal **exits** compared to the US, both through IPO and through acquisition. Fewer exits reflect the relatively less mature status of the VC health market in Europe compared to the US.

Venture financing deals have in general a strong **home bias.** But this home bias is much smaller in Europe than in the US. Especially for late stage deals, the home bias for European investors is much smaller. The stronger home

bias for the US correlates with the stronger position of the US in the global health innovation system, providing a larger supply of fundable projects.

Europe has a somewhat lower occurrence of **co-investment** deals. Syndication does not help to reduce Europe's gap in health VC deals.

Investment Funds take up the overwhelming part as type of investors of VC health deals, both in the US and in Europe. Already in Seed stages they account for more than 3 quarters of all deals, higher in the US than in Europe. But their importance as investor becomes even more outspoken in Early and even more in Late stages, where they have about 85% of deals both in Europe and US.

Within the smaller universe of late stage deals in Europe, **corporate VCs** are more important players than they are in the US, even if, in absolute terms, the number of deals in the US is still 3,5 times higher than in Europe. They have the least home bias among European VC investors, and also compared to US corporate investors. This holds most prominently for late stage deals, where less than half of their late stage deals are in Europe.

Public intervention is more prevalent in Europe than in the US: about one third of the Health VC deals involve public grant financing, while this is only 8% in the US. Also the presence of public or public-private venture capital funds is only explicit in Europe, while almost absent in the US. European public and non-profit VCs have most of their deals in the early stages. They have almost all of their deals at home (independently of the stages of their deals).

European **Angel** Investors (most prominent in Seed deals) have less home bias than their US counterparts.

European investees are less likely to be funded by a **larger-sized VC investor** than their US counterparts. European investors have a substantial size disadvantage over their US counterparts when measuring size by their number of health VC deals. Not only are European investment funds more likely to be in the smaller size categories of investors than their US counterparts, they also have relatively more deals in their portfolio in the US than their US counterparts in Europe. The US stronger home bias and the European's stronger US inclination correlates with the relative attractiveness of the US VC health market.

Taking into account the limitations of the Dealroom data at hand, the main takeaway from this analysis seems to be that while progress has been made for the seed stage, the weakness of the European health VC market continues to hold in the early and late stages, where less progress seems to have been made. What the European health VC market appears to be particularly missing compared to the US are larger sized-investors (investment funds), with late stage deals.

This calls for more policy attention to identify and reduce barriers for European health VC investors to grow to a critical scale, to be able to engage in more and larger sized deals, including especially late stage deals. This involves ensuring a sufficient supply of attractive potential deals typically at home. This calls for policy to simultaneously identify and reduce barriers for European health start-ups to develop their projects to a larger scale, ensuring a richer supply of attractive projects including late stage ones that can be funded at home. Such a richer European supply would help to reduce the relatively stronger inclination for European corporate VC investors towards US deals. In order to reach higher deal sizes, co-investing is an option that still has room for expansion.

The strong home-bias that is quite natural in VC markets makes it more difficult to attract US VC investors to fill the gap in VC deals for European investees. Nevertheless, our analysis shows that the larger-sized US private investment funds, being the least home-biased among US VC investors, might be important targets to consider including for co-investment deals with European VC partners.

All in all, Europe should further develop and strengthen its strongest asset, *i.e.*, its Open Single Market, reducing the fragmentation in flows of venture capital, reaching a truly single European Venture Capital market which is open beyond the EU27, to Switzerland, UK, US and beyond. But also furthering the Single Market for health products and services more generally will improve the commercialization perspectives for EU health innovators when scaling up their projects. For an EU open strategic autonomy industrial policy for health, an open single market for health remains the critical instrument to further develop and monitor.

1. Introduction: European's innovation landscape

Innovation is crucial to ensure Europe's competitiveness. While the EU is a key player in knowledge production, translating its innovation capacity into performance has been a persistent challenge. Policy efforts are continuously being made to improve the EU's innovation-based performance, as exemplified by the recently adopted New European Innovation Agenda[1].

Over the past 10 years, the EU Industrial R&D Investment Scoreboard has shed light on the ongoing global technology race of companies that especially involves three major sectors (ICT, health and automotive) and three regions of the world (the EU, the US, and Asia). These data show how EU companies have been more successful in maintaining R&D leadership in automobiles and pharma, while they have significantly lost relative weight in digital industries and services (see a.o. Veugelers (2019), Grassano et al. (2022), Nindl et al. (2023)). Also for the adoption of digital technologies, EU firms, particularly older SMEs, are lagging behind the US (*e.g.*, Veugelers et al. (2019), EIB (2023)). With digital technologies, such as AI, a general purpose technology, any lagging digital technology adoption may hamper sustaining EU R&D leadership in other digital technology using sectors, such as automobiles and pharma.

With the US, and more recently China, hosting most of the new R&D leaders, especially in digital sectors but also in other sectors, the weaker creative-destruction power of the EU corporate R&D system, generating fewer new superstar firms and agile incumbents, as well as its missing scale and incumbency advantages in digital could contribute to a shifting regional R&D pattern to Europe's detriment in favour of the US and Asia (China).

Current challenges from the post-COVID recovery, climate change and green transition, challenges from geo-economic tensions and geo-fragmentations further add to the uncertainty facing EU firms when contemplating long-term R&D investments, challenging lead positions which EU firms currently may still hold, as well as challenging the development of new leading positions.

Access to finance is an important condition for the type of investments required for European firms' supporting and building their leadership positions. While large incumbent firms may be able to fund their own innovative investments and access external funding, this may not hold for small, young innovative companies that lack funds and collateral. R&D investments of young leading innovators are more likely to be hampered by access to finance. Evidence has shown that this is especially likely to hold for young leading innovators based in the EU (Cincera, Ravet and Veugelers, 2015).

Financing young innovative projects requires taking risks, which is typically what venture capitalists do. Moreover, venture capital (VC) seems to contribute disproportionately to the making of superstar firms (unicorns), as superstar firms are much more likely to have been VC-backed (Akcigit et al., 2022). The patents of VC-financed start-ups tend to be of higher quality and more novel than those of established firms, further reflecting the unique breakthrough nature of projects with VC backing (Schnitzer and Watzinger, 2022).

Flachenecker et al. (2020) and Benedetti-Fasil et al. (2021) provide an overview of the recent trends in venture capital markets and trends in high-growth enterprises in the EU, emphasizing the importance of the contribution of venture capital markets to finance the start-up and scale-up of new risky ventures. Coad et al. (2023) assess how COVID-19 affected investment activity of vulnerable firms such as young and small firms, and high-growth firms, for which venture capital might be particularly important to boost them.

Startup and scale up enterprises and their financing constraints also score high on the EU policy agenda (see, for example, Quas et al., 2022). The New European Innovation Agenda launched in 2022 for instance, has as its first flagship, the mobilizing of institutional and other private investors in Europe to scale up European deep-tech start-ups. More recently, the Biotechnology and Biomanufacturing Communication[2] flags the relevance of access to finance to biotech firms, particularly for the scale-up stage.

We focus on one of the main pillars of Europe's innovation strengths, namely the health innovation system and look at the status of venture capital financing of health deals, comparing European deals with their US counterparts. In the global corporate health innovation landscape, Europe is challenged by a persistently strong US health innovation

[1] A New European Innovation Agenda – Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions, SWD (2022) 187 final.

[2] Communication from the Commission to the European parliament, the Council, the European economic and social committee and the Committee of the regions, Building the future with nature: Boosting Biotechnology and Biomanufacturing in the EU, Brussels, 20.3.2024, COM(2024) 137 final.

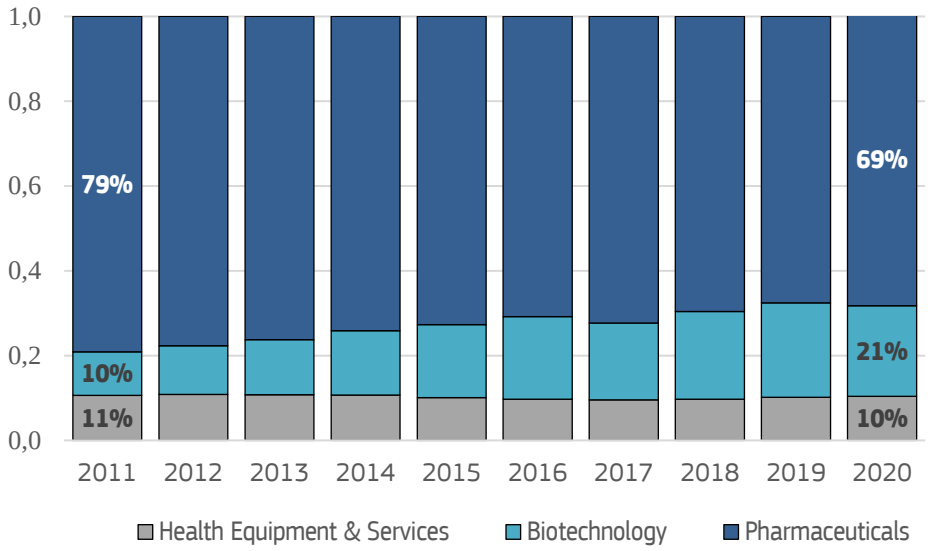
eco-system, displaying a strong Schumpeterian capacity for continuous creative destruction, with new firms quickly growing to leading positions in the sector, challenging incumbents, exploiting and driving new technology developments (like biotechnology, gene editing, synthetic biology, mRNA, artificial intelligence (AI)). The US health innovation eco-system is backed by a well-developed market for innovative health products and a well developed risk capital market. Financing constraints might be particularly relevant in health care because there is a high scientific and regulatory uncertainty, and there is a significant time elapsing from initial R&D steps and final output. Evidence from the US shows that venture capitalists play an extremely important role in driving innovation in the health sector (Chandra et al., 2022). We still lack in-depth evidence on VC health financing in Europe, a gap this work aims to help filling.

We start by sketching the health sector in the European innovation landscape and the position of Europe in the global corporate health innovation landscape (Section 2) and the importance of access to finance for health innovators (Section 3). The main focus of this work is on venture capital deals for the health sector. Section 4 sets out the data and the research questions we consider throughout the analysis. Section 5 provides the main results, while Section 6 summarizes the main findings, and Section 7 concludes with the most relevant policy implications.

2. The health sector in the European innovation landscape

In what follows we briefly sketch the health innovation landscape and the position of the EU, using the 2022 EU Industrial R&D Investment Scoreboard. We define *Health* as including Pharmaceuticals, Biotechnology and Medical Equipment & Health Services. Figure 2.1 shows the shares of each of these sectors over time. It shows the increasing importance of biotech for health innovation, as reflected in the share of R&D from dedicated biotech firms (Vezzani, 2022). Most of these dedicated biotech firms are newer firms. But increasingly also classic pharma companies are engaged in biotech R&D, often by acquiring dedicated biotech firms. Unfortunately, the EU Industrial R&D Investment Scoreboard data only provide consolidated data at the firm level, and does not allow to separate company R&D numbers by health sub-technologies. Taking into account the growing share of R&D by classic pharma companies in biotech projects, Figure 2.1 should thus be seen as a lower bound on the (growing) importance of biotech in the health innovation landscape (Vezzani, 2022). For all these reasons, we look at the health sector only in aggregate, combining biotech & pharmaceuticals and medical technologies & services.

Figure 2.1: Share of R&D across Health sub-sectors



Source: Vezzani, A. (2022) https://iri.jrc.ec.europa.eu/sites/default/files/2022-10/Vezzani_Pubsy130769.pdf/.

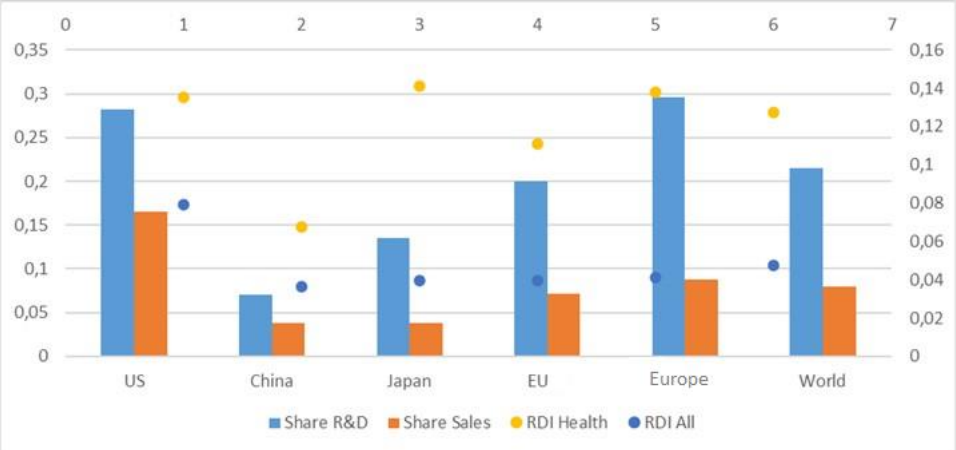
In the 2022 EU Industrial R&D Investment Scoreboard, health represents 21.5% of worldwide R&D scoreboard spending, almost equal in size to ICT producers (22.6%) and ICT services (19.8%), and substantially larger than automotive (13.9%), illustrating the importance of the sector in the innovation landscape globally. The corporate health innovation sector is most important in the US and the EU, still less so in China (Figure 2.2).

In the EU, health represents 20% of its total Scoreboard R&D, with the automotive sector the major sector for the EU27. When considering Europe (i.e., the EU27, plus the UK and Switzerland)[3], two health strongholds in Europe, the share for health increases to almost 30%, even somewhat than in the US.

In terms of R&D intensity, the health sector scores significantly higher than average, reflecting its high-tech status. China's health sector is still substantially below its world counterparts on R&D intensity.

[3] EU is used to refer to the EU27, and therefore excludes Switzerland and the UK. For simplification, it will be referred to as such in the remainder of the paper. Analysis at the European levels considers the EU27, the UK and Switzerland.

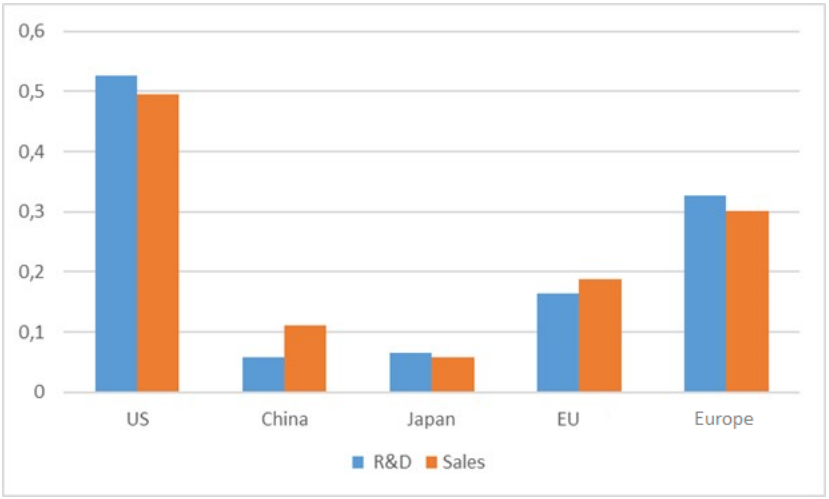
Figure 2.2: Share of Health in Region's Scoreboard R&D



Source: Calculations based on 2022 EU Industrial R&D Investment Scoreboard.

US firms are clearly the global leaders in the Health sector in the R&D Investment Scoreboard in 2022. They account for more than half of world Scoreboard Health R&D (Figure 2.3). In comparison, EU firms only account for 16% of global Scoreboard Health R&D. When including UK and Switzerland, that share climbs to 33%.

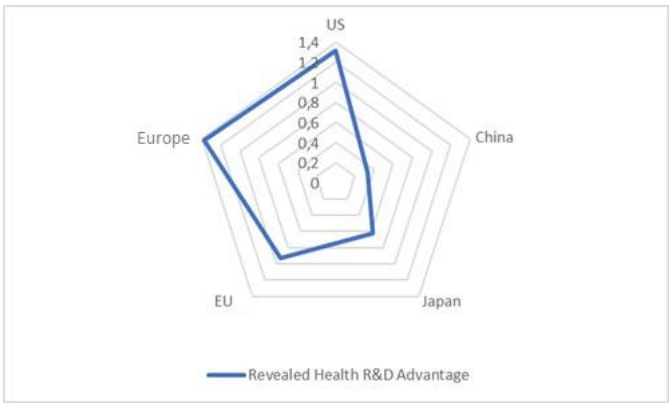
Figure 2.3: Share of Region in World Scoreboard Health R&D (2022)



Source: Calculations based on 2022 EU Industrial R&D Investment Scoreboard

Calculating the Revealed R&D Advantage (or Health R&D Specialization) of a country/region (defined as its share in Scoreboard Health R&D relative to its share in Scoreboard R&D across all sectors (with a value >1 indicating an R&D advantage/specialization in Health)), Figure 2.4 shows for the US a clear advantage/specialization in Health R&D. The EU has a value close to 1, but when considering Europe (i.e., when including the UK and Switzerland), a strong advantage in Health R&D prevails, even slightly higher than the US in 2022.

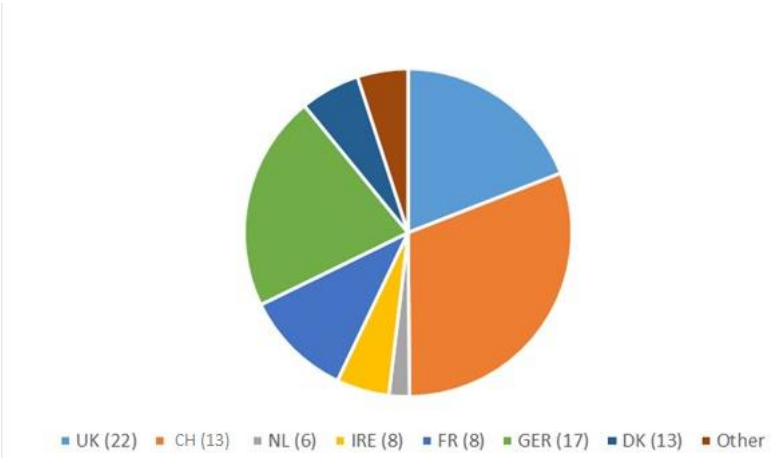
Figure 2.4: Revealed corporate R&D advantage in Health



Source: Calculations based on 2022 EU Industrial R&D Investment Scoreboard.

Figure 2.5 shows the most important countries in Europe for Health. Beyond the Swiss and UK strongholds, German and French firms have important Scoreboard firms in this sector. Also Ireland and the Netherlands have a substantial number of Scoreboard Health firms, but these are typically smaller (and younger). In addition, Ireland and the Netherlands have several health firms that are headquartered in Ireland, but have most of their activities, including their R&D activities, in the US (*e.g.*, Medtronic) or other EU countries (*e.g.*; Argenix (BEL).

Figure 2.5: Share of countries in European Health R&D

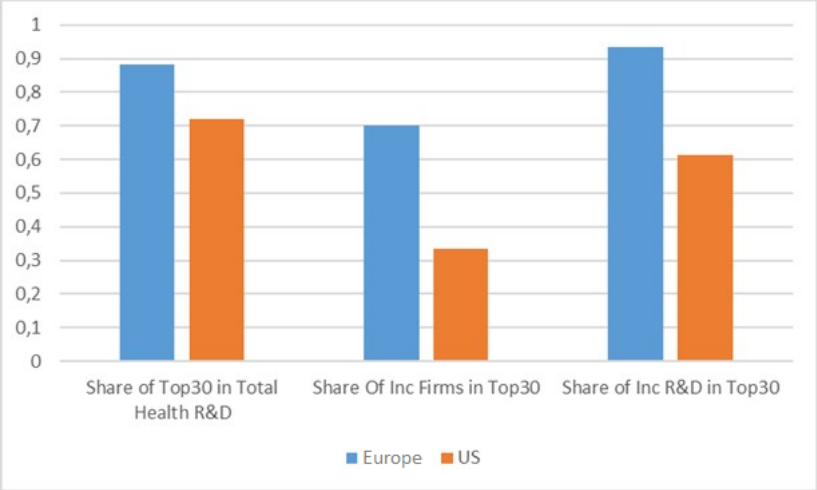


Source: Calculations based on 2022 EU Industrial R&D Investment Scoreboard.

Although the global Scoreboard Health R&D landscape is in general highly concentrated in few superstar firms, the European health Scoreboard landscape is even more concentrated than the US. The Top30 largest R&D spenders represent almost 90% in Europe versus "only" 70% in the US. And when zeroing in on the leading firms in each region, Europe has more than double as many "incumbents" among its leading firms than the US, and these "incumbents" account for more than 90% of Top 30 R&D in the EU, while the one third "incumbent" firms in the US Top 30, account for 60% ("incumbents" being companies at least 50 years old). We take this evidence as suggestive

of the lesser contestability[4] of leading positions in the European health innovation landscape by new leading firms, compared to the US.

Figure 2.6: Incumbent and New leading Firms in Health R&D (Europe and US)



Note: Incumbents are companies older than 50 years. *Source*: Calculations based on 2022 EU Industrial R&D Investment Scoreboard.

Nevertheless, also in Europe, new players can quickly grow to leading positions. The two biggest new top players in the EU Health R&D Scoreboard in 2022 are BioNTech and Curevac, respectively in 9th (13th position in Europe) and 12th (16th position in Europe). They were among the top 10 Scoreboard companies contributing the most to overall R&D growth in the EU in 2022. Both BioNTech and Curevac, are still very young companies. German BioNTech was born in 2008, and Curevac in 2000. They are thus prime examples of start-ups that successfully scaled up fast to be among the leading R&D companies in the EU health sector. They are however exceptions, riding on the COVID wave. Similarly riding on the COVID wave are the more recently born Novavax (1987) in 13th position in the US, and Moderna, born in 2000, in 16th position in the US. But the US is home to many more such scale ups compared to the EU, beyond the COVID wave. For example, Gilead, born in 1987, is currently the 7th largest bio-pharma R&D spender in the US; Amgen, born in 1980 is the 8th largest.

Overall, the US health R&D landscape demonstrates more Schumpeterian creative destruction, with more new players that have scaled up and challenged incumbents, resulting in a much more contestable, dynamic health innovation landscape with higher R&D growth rates than the EU, fortifying the US world innovation leadership in this sector.

[4] See Shapiro (2012).

3. Financing Innovation in the Health Sector

Financing constraints for innovation are particularly relevant in health because there is a significant time lapse from initial R&D steps to final market access, a time path characterized by high technology and regulatory uncertainty. Furthermore, access to finance is a particularly critical factor for novel breakthrough ideas and technologies, particularly as these are more likely to be introduced by new finance-constrained players rather than incumbent big pharma. Recent evidence for the US shows that firms typically underinvest in novel drugs: even though they are more valuable than derivative drugs, they are also riskier (Krieger et al. 2022). While large incumbent firms may have the deep pockets to take on these risky investments, they may have less incentives to introduce disruptive innovations, which cannibalize on current profits. Small new firms willing to develop disruptive ideas, but lacking deep pockets, will have to find investors willing to fund their risky investments. The US has venture capitalists (Gompers and Lerner 2001; Cumming et al., 2023), who are found to play an extremely important role in driving innovation in the health sector by alleviating the finance barrier faced by young health innovators (Chandra et al., 2022).

The mRNA based Covid-19 vaccines are an illustrative recent example of the bumpy financing path of young companies who were introducing for the first time the mRNA technology for a Covid-19 vaccine, a big breakthrough technology, yet highly disruptive not only for vaccines, but for medicines in general (Veugelers, 2022). The Appendix describes in more detail the financing of the US Moderna and the European BioNTech and Curevac[5]. The funding stories of these young mRNA firms, shows the importance of private funding, especially in the risky, early stages of development of the mRNA technology. Private angel and venture capital, including corporate venture capital support from big pharma, and public equity financing, proved critical for these companies.

[5] For differences between public funding in the EU and the US, and partnerships for COVID-19 vaccine development, see also Aghion et al. (2020).

4. Assessing Venture Capital Financing in Health in Europe

Given the importance of the health sector for European's global innovation leadership, and yet the stronger position of the US with a more contestable, dynamic innovation landscape (Section 2), it is important to look at the scope for Europe to have more new firms being able to scale up to leading positions, providing a more contestable, dynamic European health innovation landscape. Having illustrated the critical role of access to risk financing for such a dynamic leading innovation landscape (Section 3), we aim at contributing to a better understanding of the financial constraints faced by start-ups and scale-ups in the health sector, comparing Europe[6] and the US. It does this by analysing venture capital financing for innovative health projects in Europe compared to the US.

Several commercial databases exist on venture capital deals, such as CB-Insights, Dealroom, Crunchbase, Pitchbook, Preqin. These databases have different coverages and exhibit sampling biases in terms of geography, industry and stage. We use data from **Dealroom**, (https://dealroom.co) covering a large set of data over time, countries and sectors. Dealroom has been used extensively for monitoring the development of startups (De Nigris et al., 2021).

As our main aim is to characterize the recent trends of funding deals for new and scaled-up firms active in health in the EU, compared to their non-European (US) counterparts, we consider a sample of investment deals involving target companies with headquarters in Europe or North America, in the period 2013-2021.

- We consider investment deals involving funded companies with headquarters in Europe or North America, taking place since 2013, to ensure that there is widespread coverage of data by Dealroom. Even though it is possible to obtain information about some companies and deals before 2012, Dealroom was founded in 2013 and, therefore, data is more complete starting from this year. In order to account for possible delays in reporting by Dealroom, our last year of analysis is 2021.
- Considering the focus of this work on the health sector, we select those deals where the funded company performs the core of its business activities in health, *i.e.*, companies with health as their first industry of activity. We also considered a broader definition of health companies, according to sub industries, tags and activity description. There are not that many observations being added, and the results are robust to the use of both definitions.
- Unless otherwise specified, we compare Europe to the US (i.e., the EU27, UK and Switzerland)

The major questions we can address with the detailed data from Dealroom are:

- How often are European new and scaled-up firms from the health sector involved in funding deals compared to their non-European (US) counterparts?
- At which stages of financing are European firms most actively involved in (compared to their non-European (US) counterpart): seed, early stage, late stage?
- How big are their deals (compared to their US counterparts)? Are late stage scale up deals smaller in size than those in the US?
- Which are the growth segments in terms of technology for financing deals? Drugs and which areas (cancer, diabetes, neurology?) Medical equipment? Diagnostics? Digital (AI) for drug development? This will allow us to identify areas of comparative advantage in Europe (US) and whether European's digital gap with the US also plays for digital health.
- Who are the investors behind these deals? At which stage of funding deals?
- Which types of VC investors: Public funds? Private investment funds? Corporates (including incumbent pharma)? Angel? Others?
- Where are they located?
- How strong is the local bias? Are European (US) recipient firms more likely to be funded by European (US) investors?

[6] Europe includes the EU27, the UK and Switzerland.

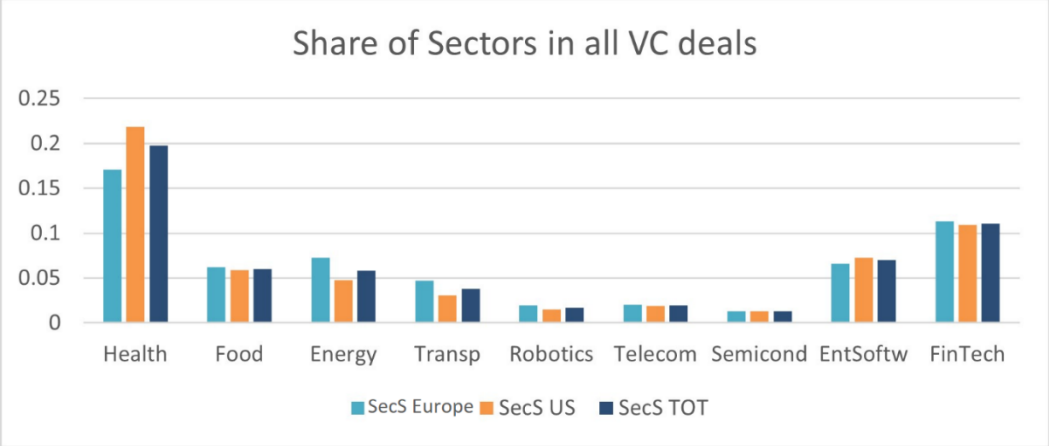
With these questions as main research questions, we aim to contribute to a better understanding of the challenges faced by Europe with respect to its position at the global Health Innovation frontier, relative to the US and how this is related to a gap in venture financing constraints. Our results should however be used carefully. To minimize the impact from lower quality information and bias in coverage from Dealroom, we will focus less on the absolute numbers and amount of deals, but more on relative results, expressed relative to similarly covered benchmarks and trends over time.

5. Results

5.1 The share of Health in total VC deals

When considering the first industry of business of the investee, Health is the sector accounting for the highest proportion of all types of deals in the Dealroom sample: from a total of more than 268,000 deals in the full Dealroom data base, approximately 19% correspond to the health sector (see Figure 5.1.1). This holds both for Europe and for the US. Taking into account potential biases caused by differences in coverage of the Dealroom, these results, when taken at face value, would be consistent with the importance of the health sector for the venture capital market and the importance of venture capital financing for the health sector. The second most represented sector according to first industry is Fintech, accounting for 11% of all deals, both in Europe and US. Software, with 7% of all deals, is the third largest VC sector. But this is more so in the US than in Europe. For Europe, the third largest sector is Energy.

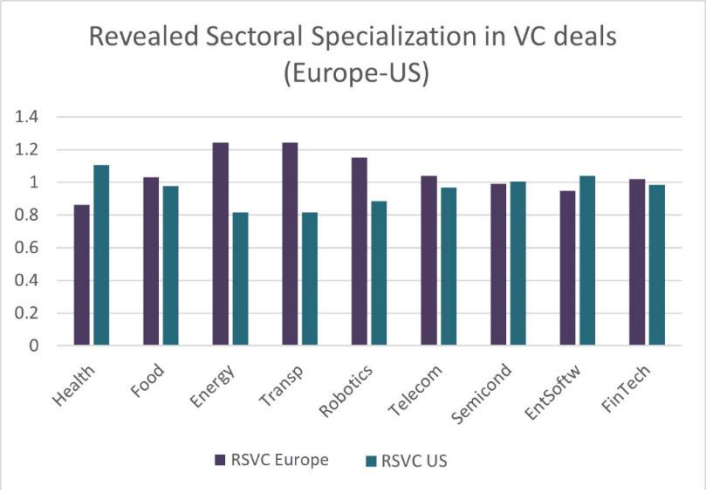
Figure 5.1.1



Source: Own calculations based on Dealroom (Europe-US; 2013-2021)

Figure 5.1.2 shows more clearly in which sectors Europe (and conversely US) hold a specialization with respect to VC deals, *i.e.*, whether their share in total VC deals for this sector is higher than their share in all VC deals across all sectors.

Figure 5.1.2



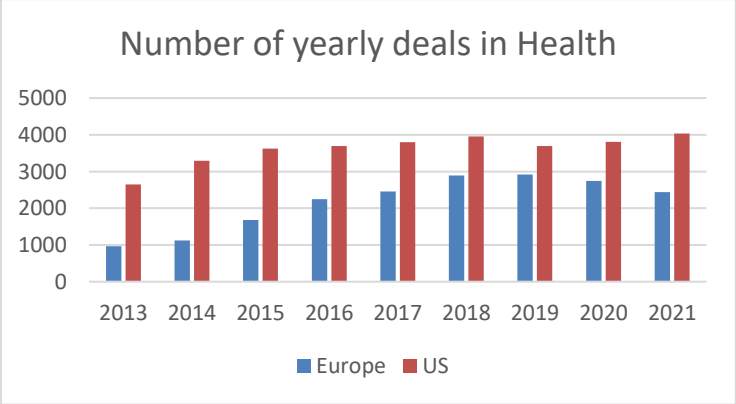
Source: Own calculations based on Dealroom (Europe-US; 2013-2021)
Note: RSVC= Share of a region in all Health VC deals relative to the share of that region in all VC deals. A value larger than 1 reflects a specialization/revealed advantage in health.

Figure 5.1.2 shows that although Health is the largest VC sector for Europe, Europe is not specialized in Health VC, while for the US it is the sector with the highest value for VC specialization. All this is reminiscent of the strong position of the US in Health VC deals. As this correlates with the strong position of the US in the R&D Scoreboard, cf supra, it is suggestive of the importance of, at least the correlation between positions in VC funding and innovation leadership in Health. In contrast, Europe has a VC specialization in Energy, and also in Transport, reminiscent of its green deal and automotive lead. On digital, where Europe struggles to catch up on its lagging position relative to the US, the picture is more mixed. While Europe holds no specialization in Enterprise Software, it holds a specialization in FinTech, and in Telecom and Robotics and is not at a disadvantage relative to the US in Semiconductors, according to Dealroom data.

5.2 Trends in Health VC Deals

Overall, the number of VC deals in health have been increasing over time, be it with waves. The average yearly growth rate in health deals over the period 2013-2021 was 7%. Growth rates were higher in Europe than in the US, respectively 11% and 5%, resulting in Europe progressing to catch up with the US. While the number of European deals was 36,5% of US deals in 2013, this gap has reduced over time. It was only 75% in 2018, but has more recently increased again to stand at 60% in 2021.

Figure 5.2.1



Source: Own calculations based on Dealroom (Europe-US; 2013-2021).

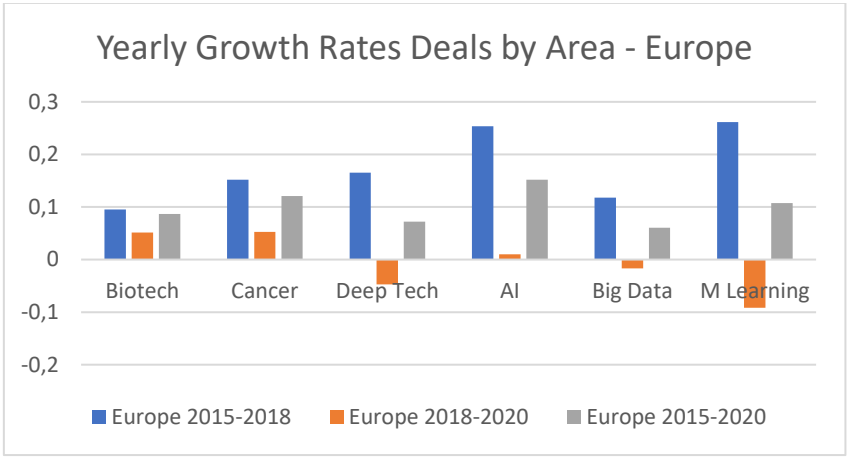
5.3. VC deals by Technology Area

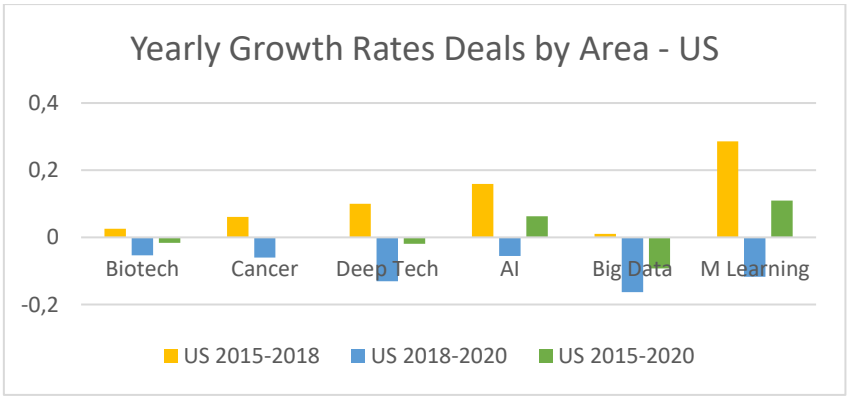
The allocation of Health VC deals to technology areas is done by using Dealroom information on sub-industries and technologies, as well as information from tags and taglines. For each field, we use text mining techniques to create different variables such as biotech, cancer, deep tech[7], artificial intelligence (AI), big data, and machine learning. The analysis based on these variables must be taken with caution as these fields are regularly missing for some deals. Moreover, these fields aim at describing activities performed by the firm and not necessarily the deal itself.

The following figures show trends and positions in Europe by area. We selected Biotech as the biggest area, Cancer as the most important drug area and a selection of Deep Tech as well as AI, Big Data and Machine Learning to reflect "digital health".

The first set of graphs shows the trend in these selected areas. It clearly shows how AI/Machine Learning were strong growth sectors, but got a hit after 2018. Also, Deep Tech got a hit, particularly in the US. The biotech and cancer areas were less affected by the 2018 hit, both in Europe and the US.

Figure 5.3.1



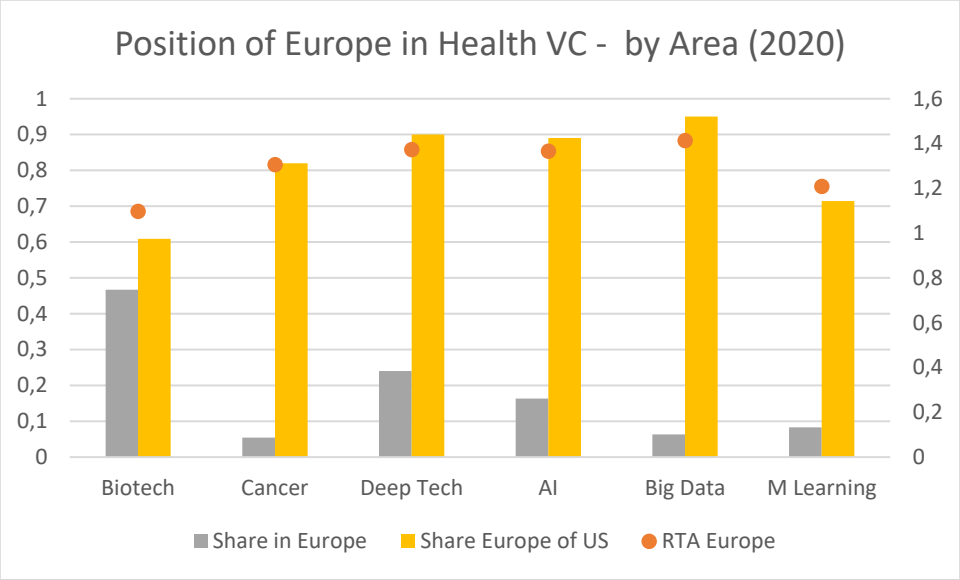


Source: Own calculations based on Dealroom (Europe-US; 2015-2020).

[7] There is no commonly used definition of deep tech, but it can be considered as a term to group companies that use cutting-edge technologies to solve complex problems (https://dealroom.co/blog/deep-tech-artificial-intelligence-europe-preview , last accessed July 1, 2024).

We next look at the position in 2020 of Europe in these selected areas, compared to the US. Figure 5.3.2 shows that BioTech is the major sector for Health VC deals in Europe, representing almost half of all deals. It is however the area where Europe has no revealed advantage. Its gap with the US in terms of number of deals stands at 60%, about the same as its average gap with the US in health VC deals. Europe's position is surprising in deep tech and AI/BigData/Machine Learning. Although these areas still represent a small share of all deals in 2020, the gap with the US is less outspoken. In all these sectors, the European share outweighs its overall share in health VC deals, resulting in a RTA score above 1. In these sectors, with a higher growth rate than the US, Europe has managed to almost catch up with the US in terms of numbers of deals.

Figure 5.3.2



Source: Own calculations based on Dealroom (Europe-US; 2015-2020)
Note: RTA Europe calculates the share of Europe in all VC deals in a subfield, relative to the overall share of Europe in all Health VC deals. A value of 1 reflects a revealed advantage/specialization of Europe in this sub-field (right-axis). Share in Europe and Share Europe of US: left-axis..

5.4 Country of investees in Health VC deals

Figure 5.4.1 shows the share of a country and region in all health VC deals in our sample (2013-2021), as measured by the country of location of the funded firms' HQ. It compares this share with the number of companies the country/region has in the Industrial R&D Investment Scoreboard in health (pharma/biotech +health care equipment & services).

Figure 5.4.1 shows that the share in VC health deals follows very closely the position of the region in the R&D health scoreboard. Yet, for the US, its dominance in VC health deals is somewhat smaller than its dominance in the Scoreboard for health R&D spenders. Conversely, the European share in VC deals is somewhat larger than its share in Scoreboard firms, suggesting that Europe is relatively more successful for VC health deals than as home for large health R&D firms. This would be consistent with a more difficult scaling up of VC funded health firms, leading to a less expanding number of leading positions in the health innovation landscape.

Within the EU, the biggest countries for VC health deals, are not surprisingly France and Germany. Germany's share in VC deals is however much smaller than its share in health scoreboard firms, the same holds for Denmark and Ireland. In contrast, France is more important in VC deals than it is in the scoreboard, like for Spain, Sweden, Finland and Belgium.

Figure 5.4.1

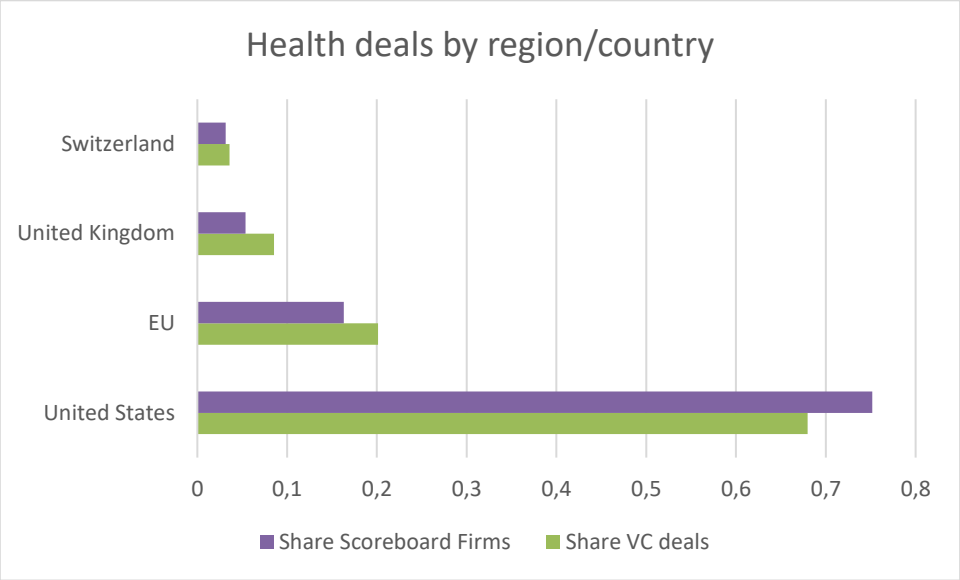
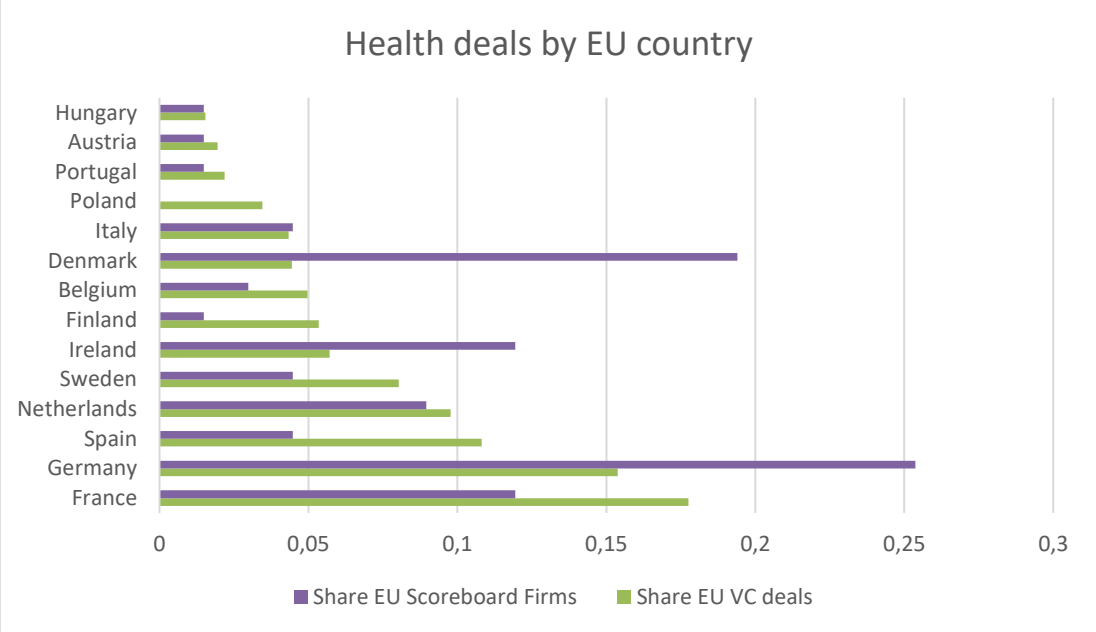


Figure 5.4.2



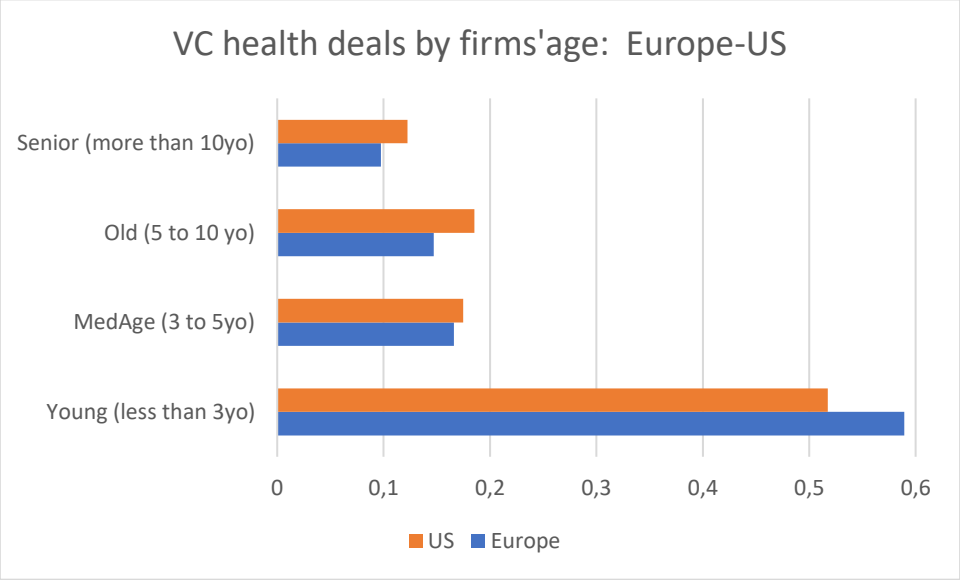
NB: Country is the country of the HQ's of the VC funded firm

Source: Own calculations based on Dealroom (Europe-US; 2013-2021) and 2022 EU Industrial R&D Investment Scoreboard

5.5 Investee's firm age

Not surprisingly, the overwhelming majority of VC health deals goes to very young firms (less than 3 years old), both in Europe and the US. Although the differences are not major, Europe has relatively more of its VC health deals for very young firms (less than 3 years old) compared to the US. The US has relatively more of its VC health deals in the >5 year olds. These different vintage structures are also reflected in the funding stages of the VC deals as documented in the next section.

Figure 5.5.1



Source: Own calculations based on Dealroom (Europe-US; 2013-2021).

5.6. Funding Stages of Health VC deals

An important analysis for assessing the constraints for start-ups and scale ups, is the VC funding by stages of development of the investee's projects. Dealroom includes different types of deals and the corresponding round of the deal. We group the round information for funding stages into three groups:

- Seed
- Early
- Late

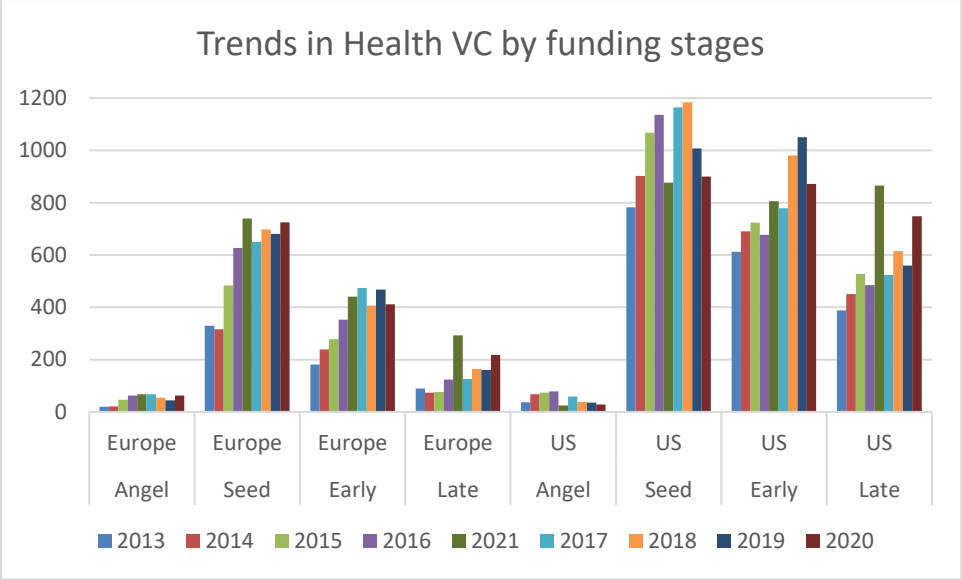
The table in Appendix shows the allocation of types of deals to the three funding stages.

Angel investment is included in seed. But given its specific role in VC funding, we will also show the data exclusively for Angel deals. Figure 5.6.1 shows the trends in deals by stage for Europe and the US over the period 2013-2020. Figure 5.6.1 plots the growth rate of deals over the considered period.

The majority of deals are in the **seed** stage. Although Europe is at a disadvantage (in terms of number of deals), it has a yearly average growth rate in this section that is higher than for the US, resulting in a catch-up in this stage, reducing the gap with the US in this stage to 60%.

The figures shows that deals with **angel investments** are small in numbers, both in Europe and the US, fairly stable over time in the US, increasing in Europe, and with no particular disadvantage for Europe relative to the US.

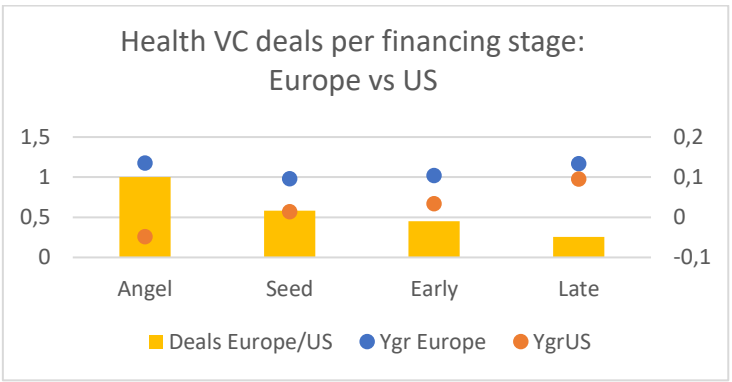
Figure 5.6.1



Source: Own calculations based on Dealroom (Europe-US; 2013-2021)

The picture begins to look less encouraging for the next stages of funding, reflecting the higher hurdles for European investees when scaling up. For the **early** stage deals, they have been increasing both in Europe and the US, but the faster growth rate in Europe relative to the US, is much smaller than for the **seed** stage, resulting in only a limited catch up in this stage, still leaving a gap in this stage, with the number of European early stage deals only 40% of the US ones. For **late** stage, this pattern becomes even more explicit: although Europe has a high yearly growth rate in these deals, relative to the US, it has the most modest growth increment. Yet, it is the stage where Europe lags the US the most, so its gap remains the largest in this stage: European deals in this stage represent only one quarter of equivalent US deals.

Figure 5.6.2

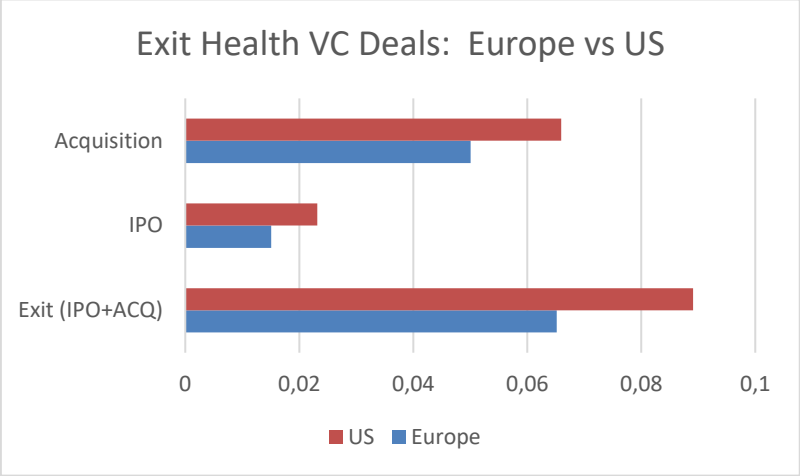


Source: Own calculations based on Dealroom (Europe-US; 2013-2021). Note: Deals Europe/US: left-axis; Yearly growth rates: right-axis.

5.7. Exit of Health VC deals

Exit options are important for a well-developed VC market. The two most important exit options are IPO or acquisition. As a share of all health VC deals in our sample, about 8% reach exit: 2% by IPO, 6% by acquisition. The predominance of acquisitions as exit mode holds both in Europe and the US. Nevertheless, in Europe, fewer deals exit as compared to the US sample, both through IPO and through acquisition. Fewer exits reflect the relatively less mature status of the VC health market in Europe compared to the US.

Figure 5.7.1

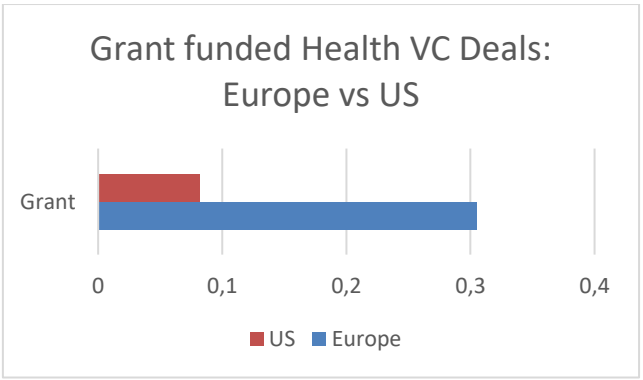


Source: Own calculations based on Dealroom (Europe-US; 2013-2021).

5.8. Grant Financing of Health VC deals

In Europe, about one third of the Health VC deals involve grant financing, while this is only 8% in the US. This correlates with the higher concern in EU public policy for barriers to access finance for innovative projects. This is also further reflected in the larger presence of public investors in European venture capital, as will be demonstrated infra in Section 5.10.

Figure 5.8.1



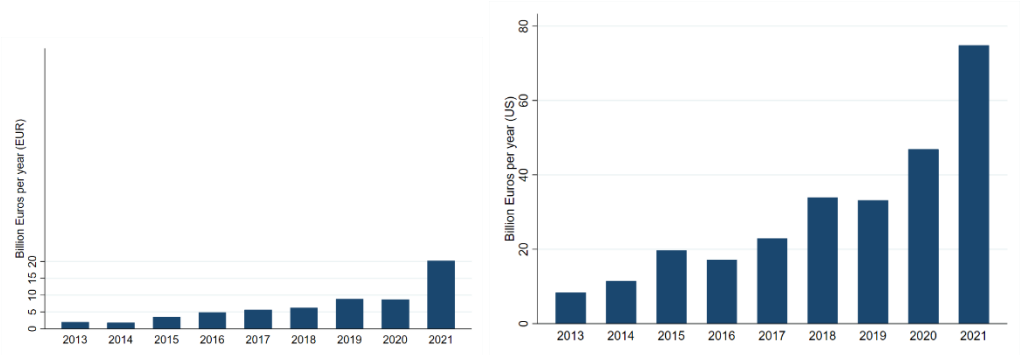
Source: Own calculations based on Dealroom (Europe-US; 2013-2021).

5.9. Deal sizes of Health VC deals

The following figures show the yearly amounts of Health VC deals over time for Europe and the US. These results have to be taken very carefully, in view of the quality of the information on the size of VC deals in the Dealroom database.

While deal sizes have increased in Europe over time, the yearly deal volumes still remain far below the US ones, again illustrating the less mature stage of the European health VC market compared to the US.

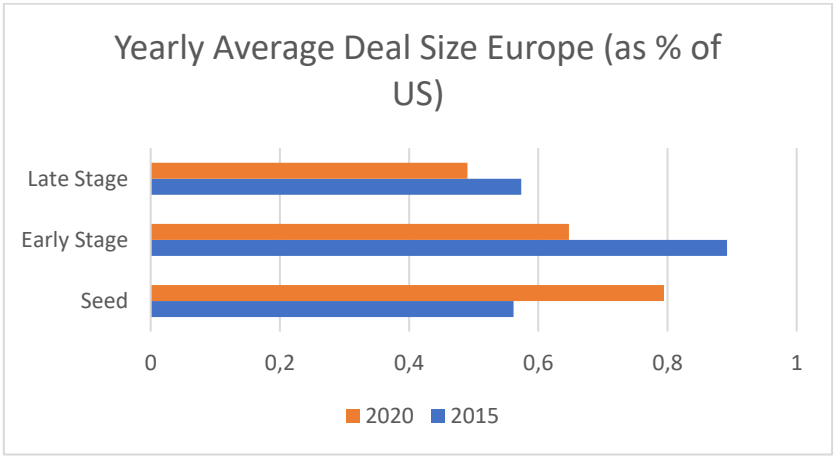
Figure 5.9.1 Total deals amounts according to companies Headquarter region of location (Europe or US)



Note: Total deals amounts in 2015 billion euros.

As the deal size is highly stage specific, with deal size increasing with later stages of financing, the next figure shows the average deal sizes split by funding stage. Figure 5.9.2 shows the average deal size for Europe per stage, expressed as a share of the corresponding deal sizes in the US. To assess trends, we compare 2015 and 2020.

Figure 5.9.2



Source: Own calculations based on Dealroom (Europe-US; 2015-2020)

The figure clearly shows how in 2020 European deal sizes are below the US and this for every funding stage, but the gaps are larger the later the stage: for Late Stage deals, the average deal size for Europe is somewhat less than half the US one. In terms of trends, the gap in deal size of Europe relative to the US has improved substantially over time for seed deals, but has widened for early and late stage.

This further confirms that, while progress has been made in Europe for smaller sized seed deals, the weakness of the European VC market relative to the US holds particularly in the larger early and late stage deals, where less progress has been made.

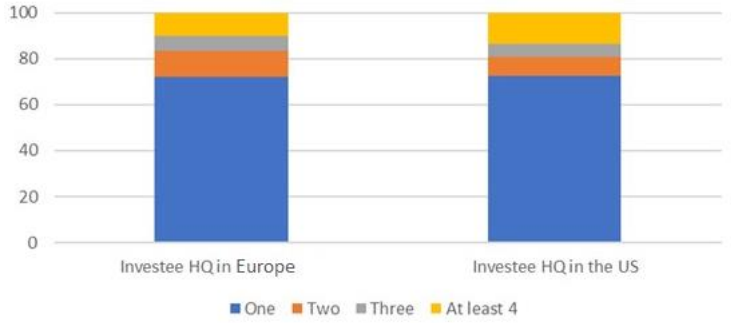
5.10. Deals by number and type of investors

In the last sections we zoom in on the supply side of the Health VC market, characterizing the VC investors. We particularly look at the type and size of investors as important characteristics to identify as "quality" indicators for the supply side of the VC health market. We do this by relevant sections of the VC market, i.e., by funding stage and comparing Europe and the US. But as deals can involve different number and types of investors, we first briefly look at the prevalence of co-investments ("syndication").

5.10.1. Number of investors and co-investment deals

Only a minority of deals in the Dealroom sample are being syndicated, both in Europe and in the US. Overall, and considering deals in which the headquarter of the investee was based in Europeor in the US, a total of approximately 72% of deals involved one single investor. While Europe has somewhat more cases of two investors, the US has more cases with a larger number of co-investors (>4).

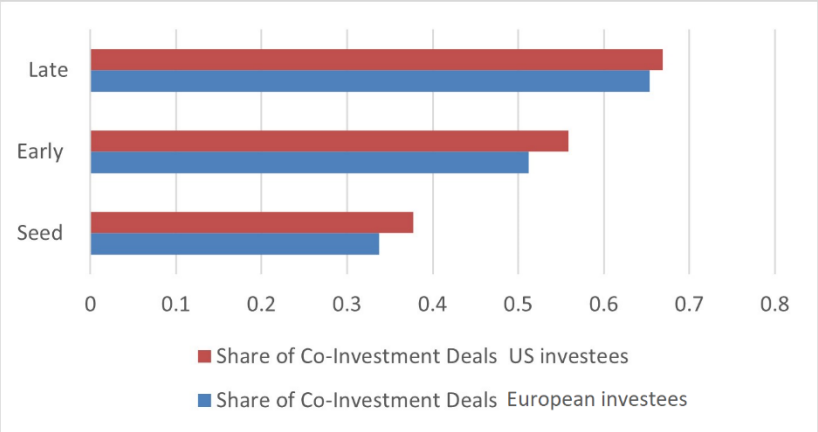
Figure 5.10.1: Share of deals by total number of co-investors (according to investees headquarter in Europe and US)



Source: Own calculations based on Dealroom (EUR-US; 2013-2021)

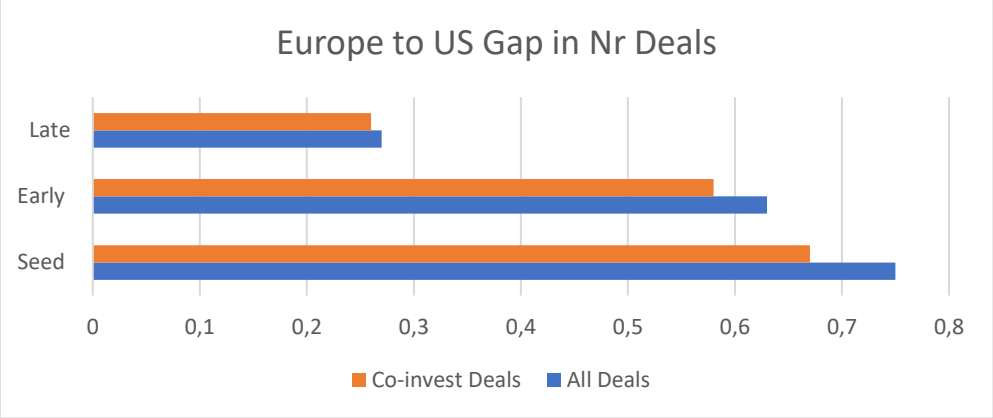
Figure 5.10.2 shows that the occurrence of co-investment deals increases with later stages, which is not so surprising given the higher deal sizes to be financed at later stages (cf supra). This holds both in Europe and the US. Europe has, in all stages, a somewhat lower occurrence of co-investment deals, a difference which is somewhat more outspoken in the Seed and Early Stages. This translates into a similar gap-position for Europe in each stage, whether or not deals are syndicated, i.e., syndication does not seem to help to reduce Europe's gap in health VC deals, especially not its gap in the larger, late stage deals.

Figure 5.10.2: Share of Co-investment in all deals; by stage



Source: Own calculations based on Dealroom (Europe-US; 2013-2021)

Figure 5.10.3: Europe's Gap in Health VC deals, by stage.

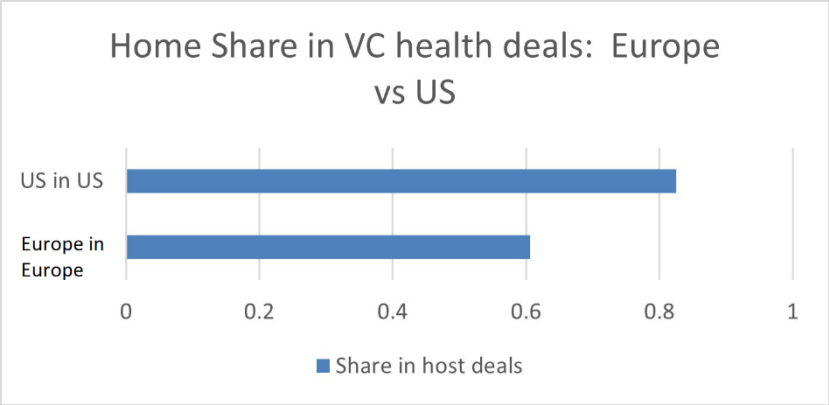


Source: Own calculations based on Dealroom (Europe-US; 2013-2021)

5.10.2 Country of origin of the investor and its Home bias

In what follows we look at the geographic matching of VC investors and investees. Figure 5.10.4 shows the clear home bias in VC deals. This is in itself not so surprising, consistent with the home bias which holds more generally in financial markets and *a fortiori* for the more risky venture capital finance. Nevertheless, the VC home bias is much stronger in the US than in the EU. More than 80% of US VC health deals are done by US investors. In the EU, this home share is "only" 60%. The stronger home bias for the US correlates with the stronger position of the US in the health innovation system, providing a larger supply of fundable projects for US VC investors.

Figure 5.10.4

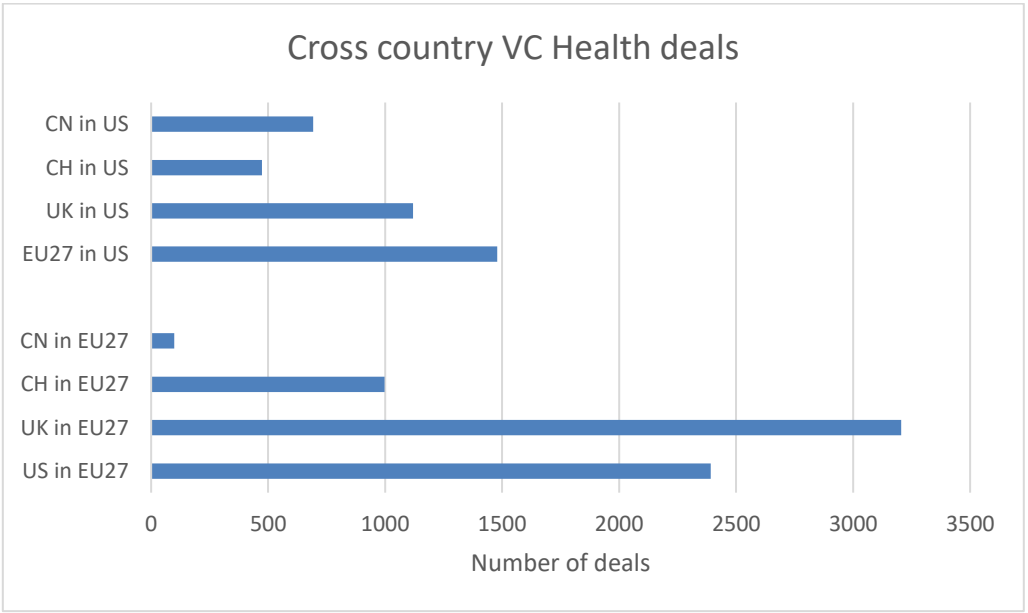


Source: Own calculations based on Dealroom (Europe-US; 2013-2021)

Figure 5.10.5 considers the EU and shows the number of "foreign" deals in the EU27 and the US. Somewhat surprisingly, given its dominance in this sector, the US is only the second largest "foreign" investor in EU27 health VC deals, with the biggest "foreign" investor being the UK, reflecting the importance of geographic proximity. Taken together, the UK and the US represent 70% of all foreign health VC deals in the EU27.

Vice versa, looking at the "foreign" deals in the US, although smaller in absolute numbers, the EU27 is nevertheless the largest "foreign" investor in US health VC deals. When including also Switzerland and particularly UK, the size of Europe as "foreign" investor in US health VC deals becomes even more marked. A marked difference between the EU and the US is the presence of Asian investors in the US. China is the biggest foreign investor, with about 700 deals in total, compared to only 100 Chinese investments in EU health VC deals. Moreover, Singapore, Japan, Hong Kong, South Korea, India and Israel have a higher share in US deals than in EU deals.

Figure 5.10.5.

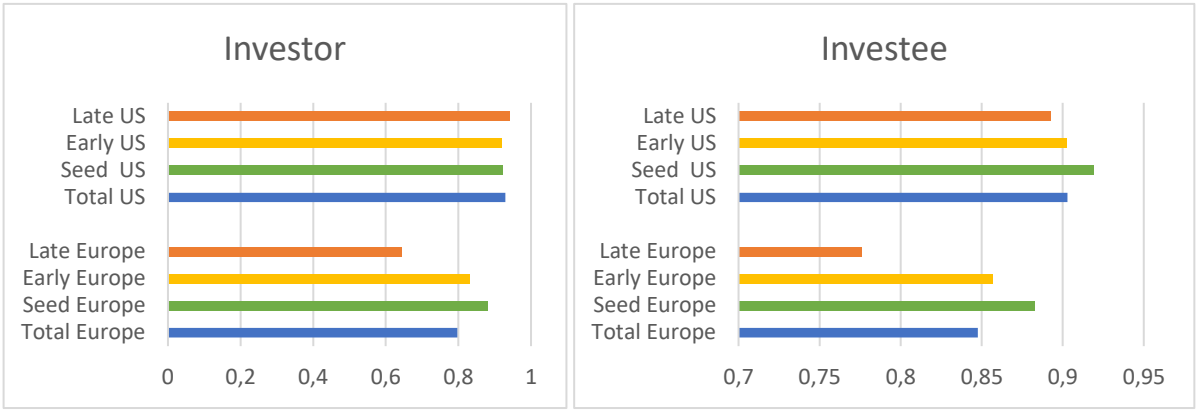


Source: Own calculations based on Dealroom (Europe-US; 2013-2021)

While the home bias does not differ substantially across stages for the US, this is not the case for Europe. Especially for late stage deals, the home bias for European investors is much smaller, with only 64% of deals by European investors being made in Europe. This mirrors also on the investee side, as for late stage deals from European

investees, only 77% are financed by European investors (compared to a home bias of 90% for the US). The difference in home bias between Europe and the US for seed and early stage deals is less outspoken. All this suggests that, especially for the larger later stage deals, it is more important for European investees to look for non-European investors than their US counterparts, who can rely more on their domestic investors even for these larger later stage deals.

Figure 5.10.6 Share of deals at home, by stage; US and European Investors (left)- Investees(right)

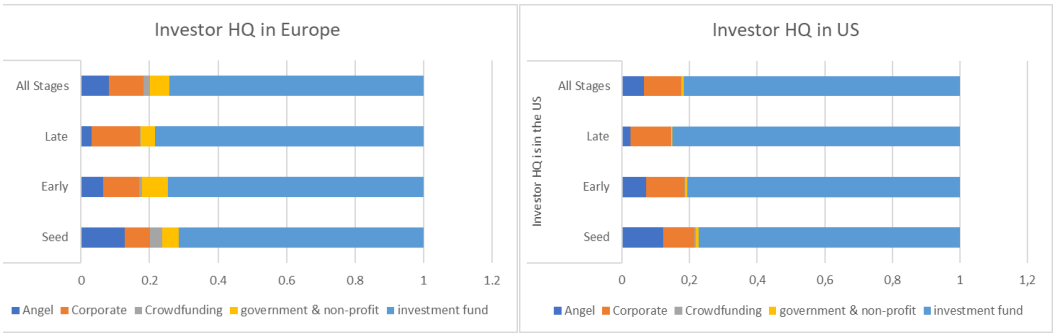


Source: Own calculations based on Dealroom (European-US; 2013-2021)

5.10.3. Type of Investors

When looking across all stages, Investment Funds take up the overwhelming part of deals, both in the US and in Europe, although their share is somewhat higher in the US than in Europe. Their dominant share holds across all stages. Already in Seed stages they account for more than 3 quarters of all deals, higher in the US than in Europe. But their importance as investor becomes even more outspoken in Early and even more in Late stages where they have about 85% of deals, both in Europe and the US.

Figure 5.10.7: Share of deals by investor type; by stage; Europe and US



Source: Own calculations based on Dealroom (Europe-US; 2013-2021)

Next to the Investment funds, Corporate VCs (almost all (Bio-)Pharma Companies) are second in line as investors, albeit far behind Investment Funds, representing not more than 10% of deals in the US. In Europe, this is even smaller, particularly in the Seed stage, where they only have 7%. In the Late stage, this however doubles to 14% (compared to 12% in the US). Within the smaller universe of late stage deals in Europe, corporate VCs are more

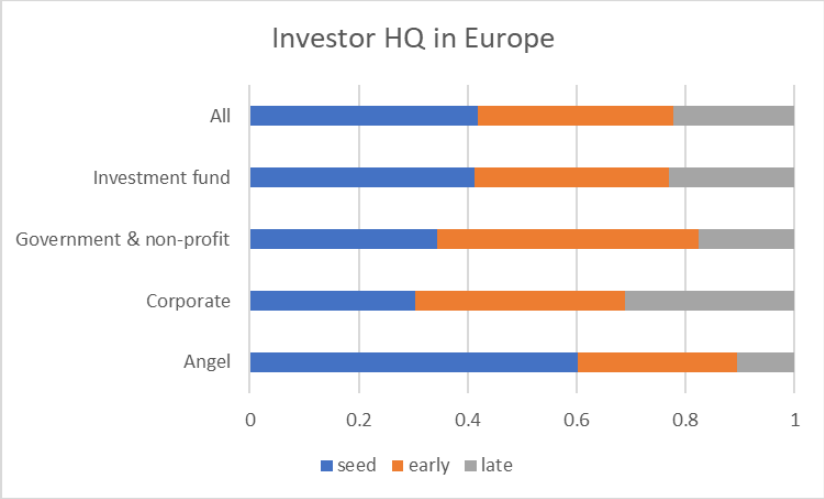
important players than they are in the US, even if, in absolute terms, the number of deals in the US are still 3,5 times larger than their European ones.

As expected, Angel investors operate mostly in Seed stage, both in Europe and the US, where they hold about 12% of deals; Table 5.12.3 confirms the prevailing dominance of deals from Angel investors to be in the Seed stage.

Government (including Public-Private) & Non-Profit are overall only of small-scale relevance in Europe, while almost virtually absent in the US. European public and non-profit have most of their deals in the early stages (see Figure 8)).[8]

Crowdfunding is still a miniature type of funding, mostly present in European Seed deals.

Figure 5.10.8: Share of deals in stages; by major investor type; European investors

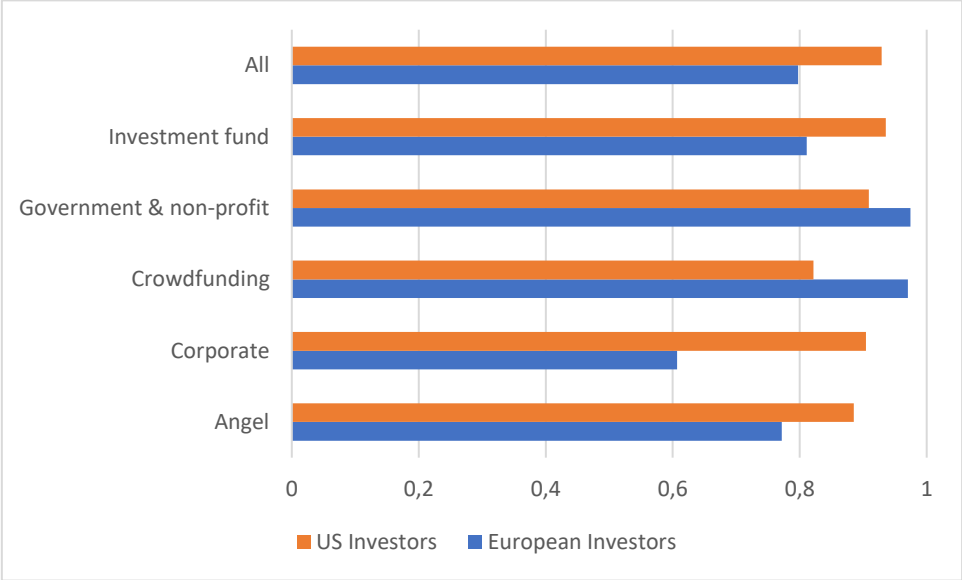


Source: Own calculations based on Dealroom (Europe-US; 2013-2021)

Figure 5.10.9 further looks at the home bias by investor type. The home bias differs substantially by investor type in Europe. Not surprisingly, the public and non-profit investors, as well as crowdfunding, basically only present in Europe, have almost all of their deals at home (and this across all stages). Surprisingly, European Angel Investors (most prominent in Seed deals) have less home bias than their US counterparts (78% compared to 90%). Also, European corporate investors are less localized, compared to other European funders, and compared to US corporate investors (60% versus 90%). This holds most prominently for late stage deals, where less than half of their late stage deals are in Europe (Figure 5.10.9), possibly reflecting a ticker more attractive supply of late stage deals in the US.

[8] For more on government venture capital see Dechezlepretre and Fadic (2022) and Testa et al. (2023); and for differences between public grants and venture capital financing, see Belluci et al., (2023).

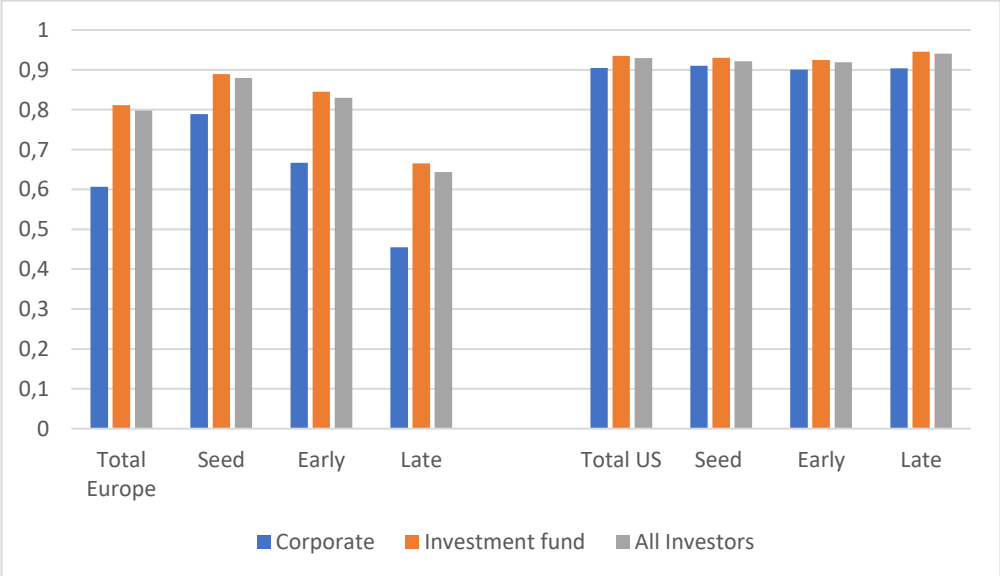
Figure 5.10.9: Share of deals at home; by investor type (Europe vs US)



Source: Own calculations based on Dealroom (EUR-US; 2013-2021)

Figure 5.10.10: Share of deals at home; Europe (left) -US (right);

By stage; By major investor type.



Source: Own calculations based on Dealroom (Europe-US; 2013-2021).

5.10.4. Size of Investors

Another important dimension to characterize the development of the VC market is the size of the investors. We measure size by the number of health deals investors are involved in. A larger number of health deals allows investors to build a critically scaled portfolio allowing risk spreading, scale advantages and expertise building in selecting and supporting health VC investees.

If we focus our sample on only investors with more than 30 deals, and further divide this sample into size categories: (30-50; 50-100; 100-200; >200), we see first a quite substantial concentration of the health VC market in big investors: the 30 largest investors (each with >100 deals) represent about 31% of the deals in this sample, the 5 largest investors (each with >200 deals), account for about 10% of all deals in the >30 sample.

We see substantial differences between Europe and the US in the size distribution of its investors. In the subsample of investors with more than 30 deals, the US has about 159 such investors, Europe has only 61, of which the UK has 20, and Switzerland has 12. The share of European investees among all deals becomes smaller, the bigger the size of the investor: European investees are less likely to have a big investor than their US counterparts. The share of European investors in numbers of deals decreases the larger the size category of investors: all 5 largest (in the >200 size category) are US investors, 20 out of the 25 in the 100-200 category are US firms.

Table 5.10.1: European-US investors, by size categories

	>200	**100-200**	**50-100**	**30-50**
Nr of Investors	5	25	73	127
Share of All Deals	9.89%	21.87%	33.84%	34.4%
Share of European investees in deals	12.5%	24.10%	23.50%	27.7%
Nr European Investors	0	5	18	38
Nr US Investors	5	20	53	81
Share in Deals by European Investors		20.35%	25.32%	32.07%
Share of European investors deals in Europe		84.76%	71.74%	73.81%
Share of US investors deals in Europe	12.49%	8.56%	7.37%	7.30%

Source: Own calculations based on Dealroom (EUR-US; 2013-2021).

Not only does Europe have fewer "large" and particularly "very large" VC health investors, the larger the size of European investors, the higher their home bias. For the US, the opposite relationship holds: the larger the investor, the smaller its home bias. The bigger US investors and particularly the Top 5 have a higher proportion of their deals in Europe.

Part of the European-US differences in the size of investors are due to the differences in the type of investors. As already discussed supra for the total sample, the biggest category of investors is Investment Funds, both in Europe and in the US. Comparing the size of European and US Investment funds, we see substantial differences. In the US the share of investment funds among all types of investors is overall very high, but their dominance is most outspoken the larger the size category. The top 5 biggest US investors are all Investment Funds (*YCombinator*, *SOSV*, *NEA*, *Khosla*, *OrbiMed*). Also in the 100-200 size category, all but 1 (the Non-Profit *MassChallenge*) are Investment Funds. Furthermore, the US Investment Funds with >100 deals include the largest VC firms worldwide across all sectors (*Sequoia*, *Andreesen*, *Kleiner*, *Khosla*, *New Enterpise Associates*, *Founders Fund*), offering further scope advantages for the venture deals in health they are engaged in as part of their larger portfolio.

In Europe, the 5 largest VC investors (all in the 100-200 category), only include 1 Investment Fund (*Sofinnova Partners*,FR) next to 1 corporate (*Novo Holdings*, DK) and 3 public or public-private funds (*BPI* (FR), *EIC* (EU), *HT Grunderfund* (DE)). Also in the size category (50-100), only half of the investors are Investment Funds (compared to 96% in the US). Only in the size category (30-50), Investment Funds are as well represented in Europe. But overall, Europe is compared to the US missing Investment Funds in the largest size categories.

Not only are European Investment Funds more likely to be in the smaller size categories, but also their home bias is less outspoken than their US counterparts: although they all have their majority of deals at home, they have relatively more deals in their portfolio in the US than their US counterparts in Europe, reflecting the attractiveness of the US VC health market (Table 5.10.2).

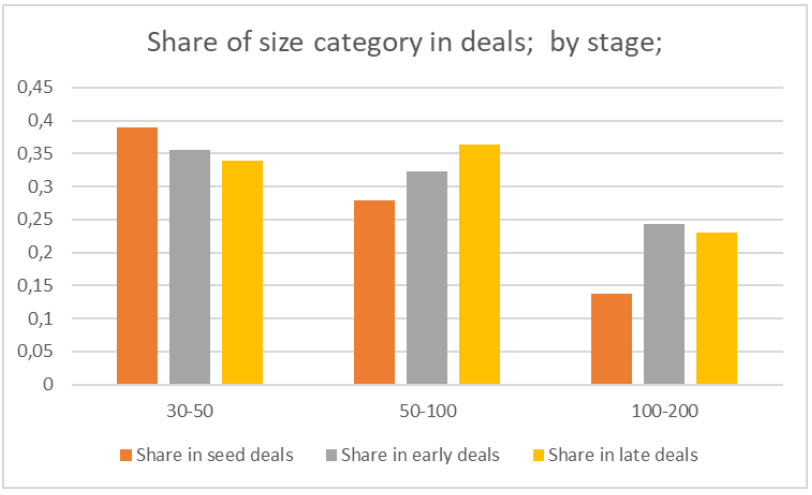
Table 5.10.2: Europe versus US >30 Investment Funds; Home Bias by size category

	Europe Investors				US Investors			
	>200	**100-200**	**50-100**	**30-50**	**>200**	**100-200**	**50-100**	**30-50**
Number of Investment Funds	0	1	10	34	5	19	51	71
Share of Investment Funds in all investors		20%	55.56%	89.47%	100%	95%	96.23%	87.65%
Share of all deals		5.47%	31.20%	63.33%	14.36%	23.44%	34.41%	27.78%
Share of deals in US		27.43%	19.53%	26.36%	87.51%	92.96%	92.85%	92.88%
Share of deals in Europe		72.57%	80.47%	73.64%	12.49%	7.04%	7.15%	7.12%

Source: Own calculations based on Dealroom (EUR-US; 2013-2021).

Finally, the Europe-US differences in size of investors also correlate with the European-US differences in deal profiles of investors across stages (seed, early, late), particularly with a larger scale for late stage deals. Figure 5.10.11 shows the market share of each investor size category and this for seed, early and late stage market segments. We do not show in the figure the >200 size category, as these are only 5 firms. Of the 5 biggest US investors with >200 deals, 2 specialize and are only big in Seed (Ycombinator, SOSV) 2 specialize and are only big in Early and Late Stage (OrbiMed & NEA), while one is diversified and big across all stages (Khosla).

Figure 5.10.11



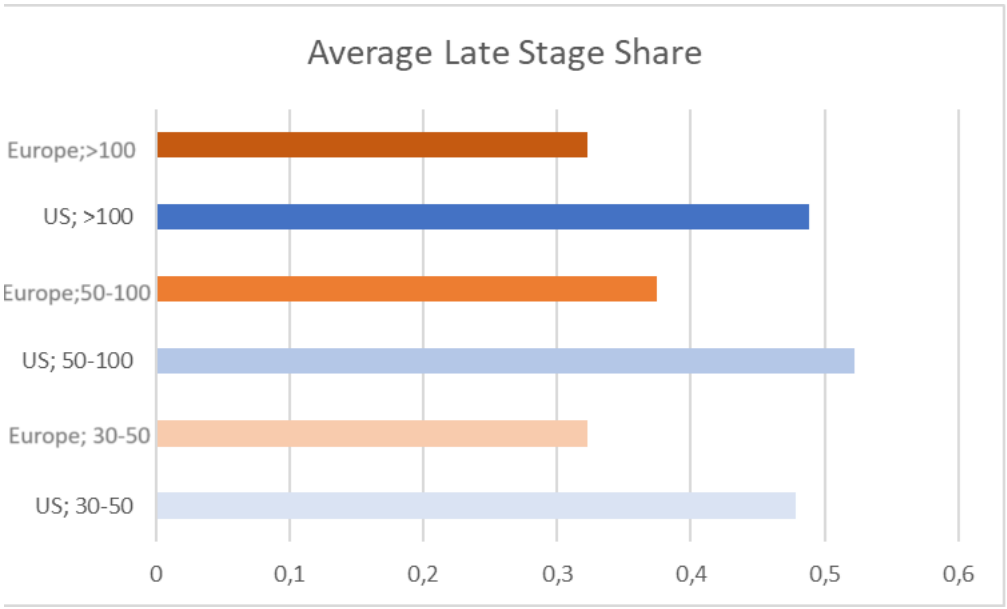
Source: Own calculations based on Dealroom (Europe-US; 2013-2021).

Figure 5.10.12 shows how the market share for the smaller size category 30-50 decreases for later stage deals, while the opposite holds for the >50 size categories, illustrating that the size of investors matters more for latter stage deals; Of all 233 investors in our sample with > 30 deals overall, 78 have >30 late stage deals, only 31 have

>30 seed stage deals, further confirming the late stage segment to be more concentrated on larger scale investors than other stages.

Figure 5.10.12 looks at the specialization of investors in specific stages of the deals, particularly in late stage deals. It looks at the share of late stage deals in the portfolio of the investors, and this by size category of the investor, comparing European and US investors. It shows how European investors are lagging behind their US counterparts in their specialization in late stage deals in their portfolio of health projects. This holds across all size classes.

Figure 5.10.12



Source: Own calculations based on Dealroom (Europe-US; 2013-2021).

The gap of European investors relative to their US counterparts in specializing in late stage deals matters most in the largest size categories. The difference between the number of European and the US investors who are big in late stage deals, i.e., have >30 late stage deals, is stark: 8 versus 65. Of these 8, six are Swiss or from the UK.

Of the 5 biggest European investors with >100 deals, the two private investors (*Novo* and *Sofinnova*) are big and specializing in early and late. Of the three (co-)public investors, only French *BPI* is diversified and big in all stages, *EIC* is specialized and big in early stage, German *HT Grunerwald* in seed and early.

All this illustrates what the European health VC market is particularly missing compared to the US are larger-sized investors, big and diversified across all stages and particularly big and specialized in late stage deals.

6. Summary of main findings

In the global health innovation landscape, the EU is challenged by a persistent leadership of the US, with US firms representing more than half of world health R&D investments in the 2022 EU Industrial R&D Investment Scoreboard. Furthermore, the EU corporate health innovation landscape is more concentrated in top firms, and more of its top leading firms are older "incumbents". In contrast, the US has a larger share of leading firms that are newer firms. All this is suggestive of the lesser contestability of leading positions in the EU innovation landscape by new leading firms, compared to the US. In the US, new health firms are less impeded than their EU counterparts to grow fast to leading innovator status, challenging incumbents. This matters as such bigger Schumpeterian "creative destruction" in the US health innovation landscape correlates with a much more dynamic landscape with higher R&D growth rates than the EU, fortifying US world leadership in this sector.

Financing constraints for R&D investments are highly relevant in the health sector. They are particularly critical for the growth and scaling up of new finance-constrained players with risky breakthrough ideas and technologies. Differences in access to risk finance between European and US health innovators, which are mostly differences in access to venture capital for start-ups and particularly scale-ups, may thus be a likely candidate to drive differences in the Europe-US dynamic innovative performance in health and the contestability of their corporate health innovation landscapes.

Given the importance of better understanding the financial constraints faced by start-ups and scale ups in Europe, providing a more contestable, dynamic European health innovation landscape, this contribution analysed venture capital financing for innovative health projects in Europe compared to the US. Our analysis aimed to shed some light on whether the Europe-US gap in dynamic innovative performance in health R&D investments in the Scoreboard can be related to a gap in venture financing constraints. To this end, we compare the trends in European and US VC funding of health deals. To test any differences in Schumpeterian "creative destruction" and contestability of leading positions in the health innovation landscape, we looked not only to the seed financing of start-ups, but also to the venture financing of the bigger, later stage deals for scale-ups. We also looked at the type and size of investors as important characteristics to identify as "quality" indicators for the supply side of the VC health market.

Our analysis used data from Dealroom. Potential measurement errors and biases in the Dealroom data call for a cautious stance in interpreting our results. Taking into account these data limitations, our main results can be summarized as follows:

- Europe is lagging behind the US in the number of health VC deals. The US, the global leader in corporate health innovation, is strongly specialized in Health VC deals.
- The yearly deal volumes in Europe still remain far below the US ones, illustrating the less mature stage of the European health VC market compared to the US.
- Although growth rates in the number of deals in the last decade were higher in Europe than in the US, allowing for some catching up, the gap still remains substantial.
- BioTech is the major sector for Health VC deals in Europe, representing almost half of all deals. European's position in deep tech and AI/BigData/MachineLearning is surprising. Although these areas still represent a small share of all deals in 2020, the gap with the US is less outspoken. In these sectors, Europe has managed to almost catch up with the US in terms of the numbers of deals.
- Although Europe is lagging behind the US in terms of number of seed deals, it has a yearly average growth rate in number of seed deals that is higher than for the US, resulting in a catch-up in this stage, leaving the smallest gap with the US for seed deals compared to other stages. Yet, even for seed deals the gap remains substantial, with European seed deals only about 60% of equivalent US deals.
- Although Europe has a high yearly growth rate in number of late stage deals, relative to the US, it has the most modest growth increment in this stage. Yet, it is the stage where Europe lags the US the most, so its gap remains the largest in this stage: European deals in this stage represent only one quarter of equivalent US deals.
- European deal sizes are below the US and this holds for every funding stage. However, the gaps are larger the later the stage: for Late Stage deals, the average deal size for Europe is somewhat less than half the

US one. In terms of trends, the gap in deal size of Europe relative to the US has improved substantially for seed deals, but has widened for early and late stage.

- In Europe there were fewer deal exits as compared to the US sample, both through IPO and through acquisition. Fewer exits reflect the relatively less mature status of the VC health market in Europe compared to the US.
- Venture financing deals have a strong home bias, but the home bias is much smaller in Europe than in the US. Especially for late stage deals, European investors are much more likely to fund US deals than US investors funding European deals. The stronger home bias for the US correlates with the stronger position of the US in the global health innovation system, providing a larger supply of fundable projects.
- Europe has a somewhat lower occurrence of co-investment deals. Syndication does not help to reduce Europe's gap in health VC deals.
- Investment Funds take up the overwhelming part as investors of VC health deals, both in the US and in Europe. Already in Seed stages they account for more than 3 quarters of all deals, higher in the US than in Europe. Their importance as investor becomes even more outspoken in Early and even more in Late stages, where they have about 85% of deals both in Europe and US.
- Within the smaller universe of late stage deals in Europe, corporate VCs are more important players than they are in the US, even if, in absolute terms, the number of deals in the US is still 3,5 times larger than their European ones. They have the least home bias among European investors, and also compared to US corporate investors. This holds most prominently for late stage deals, where less than half of their late stage deals are in Europe.
- Public intervention is more prevalent in Europe: about one third of the Health VC deals involve grant financing, while this is only 8% in the US. Also, the presence of public or public-private venture capital funds is only explicit in Europe, while virtually absent in the US. European public and non-profit have most of their deals in the early stages. They have almost all of their deals at home (independent of the stages of their deals).
- European Angel Investor (most prominent in Seed deals) have less home bias than their US counterparts.
- European investees are less likely to be funded by a larger sized investor then their US counterparts.
- European investors have a substantial size disadvantage over their US counterparts, with size measured by their number of health deals.
- Not only are European Investment Funds more likely to be in the smaller size categories of investors, but they also have relatively more deals in their portfolio in the US than their US counterparts in the Europe, reflecting the attractiveness of the US VC health market.

Taking into account the limitations of the data at hand, the main takeaway from this analysis seems to be that while progress has been made for the seed stage, the weakness of the European VC market continues to hold in the early and late stages, where less progress seems to have been made. What the European health VC market seems to be particularly missing compared to the US are larger-sized investors (investment funds), with late stage deals.

7. Some concluding policy implications

In order for Europe to ensure its position at the global innovation frontier in health, it will need to have a more contestable corporate innovation system, with firms with new disruptive breakthrough projects able to reach critical scale and/or challenge incumbents. To do this, Europe must address its gap with the US in venture capital funding for health.

Taking into account the limitations of the data at hand, the analysis has highlighted the major weakness of the European VC market to be in the early and late stages, where less progress has been made. What the European health VC market is particularly missing compared to the US are larger sized investors (Investment Funds), with late stage deals.

This calls for more policy attention to identify and reduce barriers for European health VC firms to grow to a critical scale, to be able to engage in more and larger sized deals. This involves simultaneously reducing barriers for European health start-ups to be able to develop their projects to a larger scale, ensuring a larger supply of attractive projects including late stage ones that can be funded at home. Such a richer European supply would help to reduce the relatively stronger inclination for European corporate VC investors towards US deals. In order to reach ensure larger, late stage deals, co-investing is an option that still has room for expansion, compared to the US.

The strong home bias that is quite natural in VC markets makes it more difficult to try to attract US VC investors to fill the gap in VC deals for European investees. Nevertheless, the larger-sized US private investment funds, being the least home biased, might be important targets to consider e.g. for co-investment late stage deals.

All in all, Europe should further develop its strongest asset, i.e., its Open Single Market, reducing the fragmentation in flows of venture capital, reaching a truly single EU Venture Capital market which is open beyond the EU27, to Switzerland, UK, US and beyond.

But also furthering the Single Market for innovative health products and services more generally will improve the commercialization perspectives for European health innovators when scaling up their projects. For an EU open strategic autonomy industrial policy for health[9] an open single market for health remains the critical instrument to further develop and monitor.

[9] See Amaral-Garcia et al. (2023) for critical research and policy questions related to open strategic autonomy and industrial innovation.

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List of abbreviations and definitions

AI	Artificial Intelligence
R&D	Research and Development
VC	Venture Capital

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Annexes

Annex 1. Major investors in Pharma Scale up Cases: Moderna, BioNTech, Curevac (until 2020)

Source: websearches and Crunchbase

BioNTech's initial financing came from various private venture capital sources. The German Strüngmann brothers were early investors in BioNTech, and are currently the majority shareholders. BioNTech's 2018 partnership with Pfizer provided financing for the development of its mRNA platform. And right before the outbreak of the pandemic, BioNTech raised $150 million via its Nasdaq IPO.

Public funding for BioNTech pre-COVID-19 was limited. The ERC grant its founder Sahin received in 2018 was for his mRNA cancer research. The EIB provided a €50 million loan in December 2019 for its work on cancer treatments. Public funding became more substantial after the pandemic outbreak, most notably from the German government and EIB loans.

Moderna received substantial public money in its early stage. A 2013 DARPA grant of up to $25 million for developing mRNA-based therapeutics was small but critical, because of its early stage. In its early stage, Moderna also secured substantial venture capital funding from various sources. Unlike BioNTech, Moderna did not enter into co-development agreements with big pharma. Nevertheless, it benefitted from the deep pockets of big pharma through several corporate VC deals. Like BioNTech, it also went public with its December 2018 IPO on Nasdaq, raising $600 million. Since the outbreak of the pandemic it has received substantial public funding from DARPA and BARDA. Also the returns made on its advance purchase agreements with the US, and later, to a smaller extent, with the EU, filled its financial pockets.

In its early years, **Curevac** had to rely on private venture capital, initially mostly small amounts from friends and family. The most important early venture capital funding came from German billionaire Dietmar Hopp, who co-founded SAP. The Gates Foundation and Baillie Gifford (which also invested in Moderna) also jumped in as early equity investors. CureVac went for an IPO somewhat later than BioNTech and Moderna. 2020 turned out to be a good year for CureVac to attract public funding, following an apparent attempt by then US President Donald Trump to secure CureVac vaccine supplies. Equity investment from KfW, a German public development bank, grant funding from BMFB, debt financing from EIB and the advance purchase agreement with the European Commission filled its coffers. It had to abandon its mRNA vaccine. Its next coronavirus vaccine is being done jointly with GSK, which has also taken an equity stake in the company.

MODERNA's Major Investors			
	VC funding	2013	$ 110m
DARPA	Contract	2013	$ 25m
Alexion Pharma	Corporate VC	2014	$ 25m
Various (incl AZ)	Late Stage VC	2015	$ 450m
Gates Foundation	Grant (HIV)	2016	$ 20m
AZ	Corporate VC	2016	$ 474m
Various	Late Stage VC	2018	$ 500m
Merck	Late Stage VC	2018	$ 125m
IPO on Nasdaq on Dec 2018; Money raised at IPO $604m;			
BARDA	Grant for COVID vaccine	2020	$ 483m
BARDA	Grant for COVID vaccine CT3	2020	$ 472m
DARPA	Grant for Small Scale Rapid, Mobile Manufacturing	2020	$ 56m

BioNTech Major Investors			
EC-H2020	ERC-AdG Grant (U.Sahin) (Cancer mRNA)	2018	Euro 2,5m
Various	Venture Capital	July 2019	$ 325m
Gates Foundation	Equity investment for preclinical mRNA based HIV&TB vaccines	Sept 2019	$ 55m (further expandable with $45 grants
IPO on Nasdaq on Oct 2019; Money raised at IPO $150m;			
EIB (EFSI)	Loan	Dec 2019	Euro 50m
FOSUN (CN)	Equity Inv (plus license to Manufacture & distribute Covid Vaccine in China)	March 2020	$ 135m
Temasek (SN)	Post IPO Equity	June 2020	S 250m
Pfizer	Partnership for Covid Vaccine	April 2020	$ 185m (of which 113 equity investment)
EIB	Grant/loan	June 2020	Euro 100m
BMBF	Grant	Sept 2020	Euro 375m

Curevac's Major Investors			
Various	Venture Capital	2010	Euro 27m
DARPA	Contract for collaboration w Sanofi & In-Cell-Art	2011	$33m
Hopp (SAP co-founder)	Venture Capital	2012	Euro 80m
EC (H2020)	Inducement Prize	2014	Euro 2m
Gates Foundation	Equity Inv	2015	$ 76m
IPO on Nasdaq on Aug 2020; Money raised at IPO $213m;			
KfW	Equity investment (23%)	2020	Euro 300m
EIB (EFSI)	Debt financing	2020	Euro 75m
Quatar Inv Auth	Equity Investment	2020	$ 126m
GSK	Equity Investment (10%)	2020	$ 163m
BMBF	Grant	2020	Euro 250m
Post-IPO equity follow-on on Febr 2021, raising $450m			

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