Article

Competition & Change

Competition & Change
2024, Vol. 28(2) 274–292

DOI: 10.1177/10245294231213414
journals.sagepub.com/home/cch
Sage

The knowledge-leveraging corporation in the neoliberalisation-financialisation nexus

Valbona Muzaka
Department of Economic History, University of Uppsala, Uppsala, Sweden

Abstract

Before the Covid-19 pandemic brought the proprietary pharmaceutical sector to the attention of the lay public, scholars had constructed a rich body of knowledge covering almost all of its aspects. But this diverse literature displays a tendency to focus on specific practices, often unarticulated with each other and detached from the broader socio-economic-political context in which the sector operates. This article aims to provide a comprehensive analysis of the radical transformations that have occurred in the sector in the context of the neoliberalisation-financialisation nexus. This vantage point enables us to grasp better the depth of these changes, especially the emergence of a new kind of corporation preoccupied predominantly with leveraging knowledge of two kinds: knowledge protected by state-backed legal (IP) titles, and that specific to orchestrating the various networks where most of research, development, and production now occurs.

Keywords

knowledge leveragers, proprietary pharmaceutical companies, neoliberalisation, financialisation, disintegration/decomposition of corporations, intangible assets

Shortages in essential pharmaceuticals in many high-income countries have led to a number of official investigations (e.g. European Parliament, 2020; US FDA, 2013) pointing the finger to all manner of issues except the radical transformations that have occurred in the *proprietary*[1] pharmaceutical sector during the recent decades. The official failure to 'see' is mirrored by the generally fragmented way changes in this sector have been analysed in the academic literature. Although the sector has consistently attracted the attention of scholars working in different traditions, the fragmentation of the current literature and its blind spots make it difficult to grasp the full nature and

Corresponding author:
Valbona Muzaka, Department of Economic History, University of Uppsala, Ekonomikum, Kyrkogårdsgatan 10, Uppsala 751 05, Sweden.
Email: valbona.muzaka@ekhist.uu.se

magnitude of the profound changes that have occurred in its entirety. A considerable number of excellent studies exist, but they have a tendency to focus on changes to certain practices, for example, the fragmentation of research and development (R&D) processes increasingly taking place outside corporate labs (e.g. Gassman et al., 2018; Nightingale and Mahdi, 2006), the increased use of intellectual property rights (IPRs) and associated litigation (e.g. Bourgeron and Geiger, 2022), challenges and opportunities posed by the rise of biotech (e.g. Coriat and Orsi, 2002), changes in the nature of scientific research that takes place in labs (e.g. Calvert, 2008; Scannell et al., 2015), and so on.

Importantly, the difficulty of forming a comprehensive picture of the changes in the sector is compounded not only by the multiplicity of disciplinary approaches that often remain unarticulated with each other, but also by a tendency to study sectoral practices in isolation from the broader socio-economic dynamics that have given rise to them. Many sectoral studies are excellent at answering 'what', 'where' or 'how' questions, but not the 'why' ones. Even when the latter is attempted, explanations remain at the sectoral level. To make but one example, the fragmentation and migration of R&D processes that were once carried out in-house is often explained on account of scientific knowledge and technologies having become too complex and too expensive to be handled alone, the rise of biotech firms and so on (e.g. Gassman et al., 2018; Rikap 2019). These are valid explanations, but I argue that one way of generating a comprehensive picture of the changes in the sector in its entirety is to locate their roots beyond the immediate sectoral settings and in the broader socio-economic phenomena that have transformed such settings in the first place. More specifically, the 'why' question can be better addressed when changes in the sector are located in the cauldron of pressures emanating from neoliberalisation and financialisation in the last three decades or so. Although they are distinct phenomena, they have combined to generate specific pressures on and responses from this (and other) sector(s) during this period, hence the nexus term.

Moreover, starting our analysis from this vantage point sheds light into the rise of a new corporate form within the sector: the knowledge-leveraging corporation. Exploring the reasons for its emergence allows us to not only capture more comprehensively the nature of changes in this sector, but also to contribute to the ongoing debate on the nature of the contemporary corporation. Most of the existing scholarship on the corporation is within law and it tends to be uncritical; largely in response to the rather more important role corporations play today, however, critical research has grown in different disciplines (e.g. Baars and Spicer, 2017; Ciepley, 2013; Rikap, 2021). Noteworthy in this kind of work on the pharmaceutical sector is a tendency to conceptualise proprietary corporations in financialised terms. This is clearly the case in the work of financialisation scholars such as William Lazonick and colleagues (e.g. Lazonick, 2015; Lazonick et al. 2017; Tulum and Lazonick, 2018) but also elsewhere: in his book *Pharmocracy*, for instance, Sunder Rajan (2017) likens proprietary pharmaceutical corporations to investment banks; in their excellent study of the financialisation of the sector, Fernandez and Klinge (2020) argue they operate as private equity firms; whereas Andersson et al. (2010) compare them to investment portfolios.

One key argument made in this paper is that the large pharmaceutical corporations are at best hybrid creatures and what they leverage is primarily knowledge, not finance. The core activity of this new corporation has increasingly shifted towards controlling and leveraging scientific and technological knowledge that is often, although not always, protected by state-backed legal titles (intellectual property, IP), and knowledge specific to orchestrating the networks where most of research, development and production activities now take place. My argument is that the emergence of this corporate form and its *modus operandi* can be better 'seen' when we locate the reasons (the 'why' question) for these changes in the neoliberalisation-financialisation nexus. This is the case even through neoliberalisation scholars themselves have not comprehensively studied this sector

nor the corporate form therein, focusing their attention instead on how neoliberalisation has affected the relevant regulatory sphere (e.g. Nik-Khah, 2014; Hogarth, 2015), and, more commonly, science/knowledge production and IPRs (e.g. Coriat and Orsi, 2002; Mirowski, 2011).

The contribution this article seeks to make to the already-rich field of pharmaceutical sector studies is primarily conceptual and two-pronged. First, I argue that there is analytical power in studying a particular sector through the prism of the neoliberalisation-financialisation nexus. The first section makes this point by highlighting in particular the interplay between these two distinct but co-constitutive phenomena. I argue that an important feature of their co-constitutive nature relates to the manner in which the neoliberal transformation of institutions of various kinds has made possible a peculiar articulation of the central logic of contemporary financialisation to take hold in this and other sectors of the economy. Primary attention in the article is paid to the neoliberal transformation of two central institutions: that of intellectual property, and of the corporation itself. The second, related, contribution is to bring to the fore the reasons for the rise of the knowledge-leveraging corporate form in this sector. A key argument here is that these institutional transformations enabled the new corporate form to emerge and continue to enable it to penetrate more deeply and better control sources of value outside its boundaries.

Discussing the proprietary pharmaceutical sector 'in its entirety' implies two things in the context of this article. First, for our purposes, the *proprietary* pharmaceutical sector consists of the 20–30 largest companies that control over 2/3 of the global pharmaceutical market (hitherto, pharmaceutical corporations). These companies – many of which, for example, Pfizer, Roche, Johnson & Johnson, AstraZeneca, became household names thanks to the Covid-19 pandemic – obviously do not exhaust the pharmaceutical sector but they enjoy a commanding position in determining its overall trajectory. Many existing studies focus explicitly on US corporations but I want to approach this sector as one, mindful of the differences that still hold between US and other (largely European) corporations' practices. Danzon and colleagues (2003) and Montalban and Sakinç (2013), for instance, have shown that European pharmaceutical companies' practices have converged with US' ones in several respects, notably with regard to increased shareholding by institutional investors and, more generally, in terms of the reach of shareholder value as a governance strategy. Second, studying the sector in its entirety also means looking at how these corporations organise the whole gamut of activities, that is, not just research and development – the more common focus – but, importantly, also production activities, articulated together in networks of increasing complexity. It is control over these networks and their activities that enables and perpetuates the new knowledge-leveraging corporate form.

With these aims in mind, having made the case for the conceptual usefulness of the neoliberalisation-financialisation nexus in the first part, the analysis is organised as follows. The second section starts with the key insights on changes in the sector generated by various literatures and proceeds to expand this picture by highlighting the interplay between neoliberalisation and financialisation pressures and their co-constitutive outcomes. One particular characteristic of the sector that emerges here but remains largely occluded in most sectoral studies is a peculiar *decomposition-concentration dynamic*: the more vertically integrated companies of old have 'decomposed', the more widely and deeply they penetrate and control sources of value, and the more powerful they have become in the market. This dynamic, in turn, is central to the new knowledge-leveraging corporation whose emergence is explored in more detail in the third section covering, as noted, research, development and production. It concludes that while the rise of this corporate form has ensured the sector's continued profitability, it has also generated new problems (e.g. shortages) and exacerbated old ones (e.g. the R&D productivity crisis).

On the neoliberalisation-financialisation nexus

No other phenomena have so powerfully altered the contemporary socio-economic fabric than neoliberalisation and financialisation. But neat definitions of these concepts are hard to provide, largely because they both refer to several processes unfolding in different spatio-temporal contexts that inevitably generate variegated outcomes. Such difficulty is compounded by the fact that these processes are often co-constitutive of each other, as well as of the contexts in which they unfold. Although a secular tendency towards financialisation is noted in some quarters, it often refers to a phenomenon that started in North America and certain European countries around the 1980s. This spatio-temporal context overlaps with that of neoliberalism which, while boasting a pedigree stretching back to the 1930s, often denotes an epoch starting in the 1970s and continuing to this day. Their co-constitutive nature makes ascertaining causality between processes of neoliberalism or financialisation and observable outcomes in specific contexts challenging. This may be why focusing on one or the other phenomenon is preferred, occluding in the process their co-constitutive nature. The definitional problem can be overcome, for our purposes, by focusing not on their outcomes but on the distinct logics that underpin them, namely, neoliberalism's fundamentalist market epistemology and financialisation's value extraction logic.

Neoliberalism is a political project built on a complex philosophy ultimately aimed at extending the reach and operation of markets, consolidating a market-friendly regulatory sphere, and promoting individual freedoms (Jessop, 2013). Rather than a monolithic and totalising project, remaking the nexus between market, state and citizenship is attempted through transformative but uneven processes whose outcomes depend on the context they unfold (Peck, 2010). Neoliberalism's protean nature, while confusing at times, nevertheless hinges on its fundamentalist market epistemology: markets are not simply or even primarily economic mechanisms for optimal resource allocation, but rather epistemic mechanisms for optimal decision-making (Mirowski, 2011). This is not the *laissez-faire* notion of liberating markets; rather, because markets are optimal decision-makers, it implies the reorganisation of all socially significant processes, that is, not only strictly economic ones, as markets (Tyfield, 2016). As we shall see, this orientation has resulted in important institutional reconfigurations that, while central to the functioning of contemporary financialisation, were not caused by it.

Neoliberalism is a political project also because the 'hegemony of market rule' can only be achieved through, confoundedly, an activist and interventionist state. Despite being discursively distrustful of state's involvement in the economy, in practice state power is central to constructing markets and expanding their reach into as many non-economic spheres as possible (Peck, 2010). State's politico-juridical powers are indispensable, for instance, in creating and granting IP titles to certain groups, thus deliberately creating scarcity without which neither markets nor assets can exist. As will be discussed, state power has been central to the expansion and neoliberal reconfiguration of IPRs, a process that greatly facilitated the transformation of pharmaceutical corporations into knowledge-leveraging ones.

Neoliberalisation processes have generated variegated landscapes in specific contexts, often in tandem with processes of financialisation. Starting with the shift from a strictly regulated financial sector to a largely deregulated one driven by particular states, financialisation came to refer to a phenomenon with several manifestations, including the expansion and the proliferation of financial instruments and services; the penetration of such instruments and their rationales into a growing range of fields; the crowding out of non-financial investments; a new regime of accumulation where profits accrue primarily through financial channels, etc. (e.g. Epstein, 2005; Sawyer, 2013). I argue that, despite this range, financialisation currently hinges on a specific logic of value extraction in

which, *taking advantage of* the *neoliberal reconfiguration of institutions of all kinds*, financial players increasingly permeate and appropriate a growing share of value created in the economy and society.

Because the financialisation literature was spurred largely by the 2008 financial crisis, it has tended to neglect the central role that assets have come to play in contemporary political economy (Langley, 2020). This dynamic has been brought to the fore instead by the recent literature on assetisation, broadly defined as the process of converting 'things' into assets that can be owned, controlled and capitalised as a revenue stream (e.g. Birch, 2020; Birch and Muniesa, 2020). Assetisation and associated rent relations have become important mechanisms in the extraction of value from the economy and society today. As will be seen in sections two and three, the ownership and control over intangible assets – although, importantly, not only of state-backed IPRs – are central to pharmaceutical corporations operating as knowledge-leveragers. While making an invaluable contribution to understanding the distinct logic of contemporary financialisation, however, the assetisation literature has not paid systematic attention to how the deeper penetration into and extraction of value from the socio-economic sphere has been enabled by the concomitant *neoliberal transformation of various socio-economic institutional forms*. The co-constitutive nature of neoliberalisation and financialisation processes can get overshadowed here by the looming logic of asset capitalisation dynamics.

One of the most distinctive features of the current phase of financialisation is the shift away from the historically familiar way in which finance influenced the productive sphere through determining the *viability* of possible investment decisions, to the much more intrusive shaping of the very *content* of decisions made by non-financial firms (and states and households) today (Vercelli, 2013). Given such penetration, it is perhaps understandable that the financialisation and assetisation literatures have been at the forefront of scholarly efforts to make sense of changes occurring in the global economy currently. Certainly, strategies noted in these two bodies of literature, for example, those aimed at increasing shareholder value and expanding the portfolio of assets of different kinds, are used widely in the sector. But it is difficult to explain *why* these but not other strategies took hold. An important part of my argument is that the deeper and more intrusive penetration of the financial logic in various aspects of socio-economic life would have been difficult without the neoliberal restructuring of a number of institutions, which is why the neoliberalisation-financialisation nexus is proposed here as a productive conceptual lens.

The concentration-decomposition dynamic in the proprietary pharmaceutical sector

There can be no doubt that the proprietary pharmaceutical sector is financialised. Financialisation scholars have provided the evidence which can be grouped under three main 'tell-tale' signs. First is the shift towards institutional investors: for example, the same five institutional investors (BlackRock, Fidelity Investments, State Street Global, Vanguard Group and Wellington Management) are the largest shareholders in most of the US pharmaceutical corporations (Busfield, 2020; Lazonick et al. 2017). Although blockholders like business families and industrial corporations still appear in the top 50 investor in the European counterparts, the share of institutional investors' ownership has been increasing since the 2000s and, with it, the adoption of the shareholder value orientation and associated strategies (Danzon et al., 2003; Montalban and Sakinç, 2013). Among other things, the anti-competitive consequences of such ownership constitute an important antitrust issue (Auvray et al., 2021). For instance, it seems that BlackRock's ownership

shares in both Pfizer and Moderna may have enabled it to limit the mRNA Covid-19 vaccine race to its benefit.

The second 'tell-tale' sign is the dominance of the shareholder value maximisation which has made shareholder payback – in the form of dividends and buybacks – one of the main corporate 'investment' strategies in this and other sectors of the economy. More in this sector than others, for pharmaceutical corporations appear among the most extractive companies (Lazonick, 2015; Lazonick et al., 2017). During the 2000–2018 period, the total shareholder payout by 27 of the world's largest pharmaceutical corporations amounted to US$1,540 billion, a nominal increase of 400 percent (Fernandez and Klinge, 2020: 16). Meanwhile, investments in fixed capital fell (from 6 percent of net sales to 5 percent), investments in R&D increased only moderately (from 12 percent of net sales to 17 percent), and the ratio of financial reserves to fixed capital rose from 0.87 to 1.09 (*ibid*., 19, 24, 27).

To this relative decline of fixed capital investment rates, flanked by increased ownership share by institutional investors, rapidly rising rates of shareholder payouts and financial reserves, a third indicator can be added: merger and acquisition (M&A) activity. A considerable literature on the topic exists, not least because relatively high R&D expenses and complex regulatory requirements made size important to a firm's ability to succeed in this sector from the mid-20th century onwards and M&As were a common tool to achieve it. But M&A activity is now of a different nature. In *quantitative* terms, M&As claims a significant part of the sector's resources: M&A outlays from 2000 onwards overtook shareholder compensation which, in turn, overtook R&D expenses (Fernandez and Klinge, 2020: 16; Schwartz, 2016: 244). In *qualitative* terms, M&A activities have become deeply financialised because they: are central to maintaining and increasing corporate profitability and stock value; correlate closely to valuations and liquidity conditions in capital markets; and, are often orchestrated by financial actors, whether M&As are financed through companies' cash reserves or borrowing (Busfield, 2020; Fernandez and Klinge, 2020; Rikap, 2019). Pharmaceutical M&As have become much more frequent and larger in scale, increasingly being used as a strategy for neutralising competition ('killer acquisitions'), as well as for buying-in smaller, nascent or biotech firms with promising pipelines in different stages of development, new technological platforms or valuable IP portfolios (Roy, 2020; Sunder Rajan, 2017).

A lower propensity to invest is sometimes considered a 'tell-tale' sign of financialisation on its own right. Investment rates are down but perhaps less because of financialisation than assetisation. Intangible assets constitute an ever-increasing part of pharmaceutical companies' balance sheets: the ratio of intangible over total assets for the largest 27 pharmaceutical corporations increased from 13 percent in 2000 to 51 percen in 2018 (Fernandez and Klinge, 2020: 25). For some of them, this ratio is higher. Linking lower investment rates to intangible asset ratio in this sector is in line with studies showing that IP-rich companies substantially underinvest relative to their profit share (Auvray et al., 2021; Pagano, 2014; Schwartz, 2022). This intangible-asset-heavy profile enables them to shrink the physical asset and labour footprint, eschew productive investment, and throttle competition through buying up potential competitors, further reducing the pressure to invest. One would still expect pharmaceutical corporations to maintain substantial investment levels in R&D, the basis of most IPRs. It appears, however, that it is cheaper for them to obtain these via M&As and, as will shall see in the case of intangible assets under the 'goodwill' category, by maintaining tight control over networks where R&D and production now largely take place.

Both the IP monopoly and assetisation literatures have expanded our understanding of how IPRs have become key intangible assets in corporates' hands across different sectors (e.g. Birch, 2020; Birch and Muniesa, 2020; Pagano, 2014; Schwartz, 2022). Within our sector, the focus is often on how pharmaceutical patents have become the most-prized assets whose proper management is

central not only to market control but also to accruing rent income (e.g. Roy, 2020; Sunder Rajan, 2017). Since the 17th century, the concept of rent has adapted to emerging socio-economic practices (Rogers, 2023) and is primarily understood today as the income derived through the ownership, control or possession of an asset whose scarcity is ensured through legal means of limiting/eliminating competition (Christophers, 2020). Both literatures highlight how pharmaceutical patents – conceptualised both as legal entitlements and as material manifestations of future earning streams – are now largely constructed, bundled and managed as assets critical to rent extraction in the sector (Bourgeron and Greiger, 2022; Roy, 2020; Zeller, 2008).

As will become evident, my argument builds on both IP monopoly and assetisation literatures but also tries to go beyond them. Both have a tendency to focus on IPRs and often give warranted but sometimes outsized attention to patents. Patents have historically been important in the sector and there is no doubt that they have become even more important now, but so have other kinds of IPRs, for example, data exclusivity and secrets (more below). Importantly, intangible assets come in many forms; Christophers (2020) lists at least seven, of which IPRs are only one category. An exception in the IP monopoly literature is Rikap (esp. 2021) who, building among others on Durand and Milberg (2020), expands intellectual monopoly to cover various forms of knowledge assets. Leading corporations across different sectors that 'continuously monopoliz[e] access to knowledge' are labelled 'intellectual monopolies' (2021: 23). Such monopolies are seen to have emerged from knowledge-specific features: changes to IPRs and especially changes to corporate innovation systems do the heavy analytical lifting in this account at the expense of broader socio-economic phenomena – neoliberalisation and financialisation – that have transformed these and other configurations in the first place.

The case can safely be made that IPRs account for a significant part – but not all – of the increase in the intangible assets of pharmaceutical companies. It is worth noting that although IPRs generate rent income and are subject to speculation, they are statutory creatures based on state guarantees and not financial assets (Texeira and Rotta, 2012). As with other intangible-asset-heavy corporations, a significant part of intangible assets of our companies are 'undisclosed'/'uncategorised', pointing to a much larger problem that exists with the definition, identification and measurement of intangible capital in general (Bryan et al., 2022: 96). Although research on the latter is still in its infancy, there is agreement that 'unidentifiable' knowledge assets are not linked to a specific product/service and that 'goodwill' constitutes a large and increasing part of the intangible asset category overall (Baranes, 2020; Gagnon, 2007). Despite the confusion that characterises the treatment of 'goodwill' by accountants and economists alike, it generally refers to the advantage generated through the ability to control relations between various players – most commonly, customers, employees, creditors/investors and the general public (Baranes, 2020). I would argue that the 'goodwill' category can be expanded to include pharmaceutical corporations' coordination of various research, development and production networks.[2] Indeed, control over and coordination of such networks, while *not an IP asset*, is a knowledge asset and a source of rent that is central to the transformation of pharmaceutical corporations into knowledge-leveragers.

Taking stock, the picture that emerges so far is that of a corporation over whose relatively emaciated productive base towers an outsized structure consisting of intangible and of financial assets. Despite the size of the latter, I argue that the *modus operandi* of these hybrid creatures is based primarily on leveraging knowledge and not finance, as in most dominant accounts. Explaining why this knowledge-leveraging corporate form emerged necessitates exploring how the financialisation and assetisation processes discussed so far in fact exploited the dynamics first created by the concomitant neoliberal transformation of IPRs and that of the corporation. To explore these

processes, I start with the corporation, turning to the simultaneous neoliberal transformation of scientific knowledge production in the next section.

I argue that the origins of corporations' 'decomposition' are to be found in neoliberalisation and not financialisation pressures. The neoliberal transformation of the corporation can be conceptualised to have occurred along at least three dimensions. The first relates to the 'hollowing-out' of corporation's earlier hierarchical structure. The managerialist view of the corporation espoused by Schumpeter, Chandler and others gave way from the 1970s onwards to the neoliberal view of firms as a nexus of contracts between different factors of production that essentially function as any ordinary market contract (Alchian and Demsetz, 1972). Neoliberalism's market epistemology subjected the interior of the corporation to market principles, which is why the boundaries of the corporation gradually became blurred and hierarchical structures gave way to disaggregated but interrelated transactions among participating agents. In practice, the disintegration of the corporation is visible both in arms-length transactions among internal units, and in the more general trend towards outsourcing, offshoring and the acquisition of externally produced knowledge and technologies (Zeller, 2008). As will be seen, the *selective disintegration* of the lead pharmaceutical corporations has given rise to a new form of spatial organisation of the entire value creation process characterised by tight orchestration and control (Buciuni and Pisano, 2021).

This unbundling and disintegration went hand in hand with the corporation's neoliberal reconfiguration along a second dimension. From the late 19th century onwards, when they became institutions legally separated from their shareholders, corporations evolved to become, as Peter Drucker noted in 1946, one of the most representative social institutions of our time whose assets, wealth, and fortunes are created by and affect millions of people in their capacity as workers, consumers, savers, citizens, etc. (1972 [1946]: 208). Seeing corporations as social institutions was however foreign to the neoliberal view of the firm noted earlier; moreover, corporations in this view suffered from many intractable problems stemming from the separation of ownership and control. The neoliberal 'solution' came in the form of the shareholder value maximisation which would both solve the separation problem and make corporations more efficient (Lazonick, 2015). In practice, maximising shareholder interest, as we have seen, became a powerful lever for siphoning off profits out of the sector to shareholders. Here, the co-constitutive nature of neoliberalism and financialisation is clear: while a neoliberal construction, shareholder value became central to value extraction. This is so despite the fact that contemporary corporate law itself challenges the view of shareholders as owners. The corporation is legally structured to be owned by no one; shareholders own neither the corporation nor its assets, for the share is a distinctive form of property in the form of a claim on a company's profit (Ireland, 1999).

A third dimension along which the neoliberal transformation of the corporation took place relates to antitrust. Antitrust constrains post-WWII were crucial in motivating large companies across various sectors, including ours, to build their own R&D labs (Pisano, 2012). Largely driven by neoliberal ideology and pursued by corporation themselves, antitrust policies were gradually (initially in the US and then elsewhere) reconfigured from the late 1970s onwards (Davies, 2010; van Horn, 2018). Market concentration and its corollaries came to be seen as unproblematic insofar as consumer welfare was improved through lower prices – incidentally, an unknown phenomenon in proprietary pharmaceutical markets. The neoliberal reform of antitrust, unsurprisingly, sent corporate R&D labs in free-fall (Pisano, 2012). The corporate lab collapse started in earnest in the pharmaceutical sector in the early 2000s and was crucial to the development of innovation networks where most of R&D now takes place.

Once the neoliberal transformation of the corporation is taken into account, a peculiar *concentration-disintegration* dynamic becomes visible within the pharmaceutical sector. On the one

hand, the sector has become much more concentrated: the more M&As are used as a strategy to limit competition, maintain profitability and enhance the value of IP portfolios, the more concentrated the proprietary pharmaceutical market has become. Indeed, a smaller number of much larger corporations now controls the ever-growing pharmaceutical global market: the latter grew more than five times between 1975 and 2018,[3] whereas the top 10 concentration ratio increased from about 12 percent in 1987 to around 40 percent currently.[4] That they are doing quite well from this market position is confirmed by recent data suggesting that their profitability – historically above the average non-financial corporate sector – has increased even further in the recent decades (Işik & Orhangazi, 2022). But, crucially, these corporations, while more powerful and profitable than their predecessors, are comparatively emaciated and 'hollowed out'. This is not an accident, for it is precisely their organised disintegration and strict control over the entire pharmaceutical value creation process that allows them to increasingly extract value through leveraging knowledge generated outside their porous boundaries and thus enhance their market power. In short, the concentration-disintegration dynamic in the sector corresponds to the new, knowledge-leveraging corporation.

Proprietary pharmaceutical corporations as knowledge-leveragers

A general shift in non-financial corporations' source of profits towards rent income derived from the ownership and control of intangible, especially IP, assets has been noted in various sectors (Bryan et al., 2022; Schwartz, 2016; 2022). Given such role for IP assets, why not refer to the new corporate form in our sector as an IP- rather than knowledge-leveraging one? Indeed, few could argue that this particular asset form is not crucial to the sector. Certainly, pharmaceutical corporations did not discover IPRs yesterday: IPRs have historically been important tools for appropriating returns from innovation in the sector, which is why it has probably done more than any other business sector to shape domestic and – following the emergence of the WTO TRIPS agreement in 1995 – global IP regulation in its favour (Muzaka, 2011; Sell, 2003).

The growing importance of IP, especially patents, is supported by data; for instance, annual patent applications worldwide increased fivefold and eightfold for pharmaceutical and medical biotechnology, respectively, from 1980 to 2017.[5] This growth, however, does not indicate increased innovation rates in the sector; the impressive growth of pharmaceutical patents owned and controlled by proprietary corporations has been accompanied by *fewer* new drugs introduced in the market, falling from a high of 93 new molecular entities introduced annually in the 1960s to an average of 31 in the 1996–2014 period (Gassman et al., 2018: 7). The R&D productivity crisis, already noted in the 1980s, persists.

I will defend the 'knowledge-leveraging' characterisation starting first with the neoliberal transformation of scientific knowledge production and IPRs. I argue that it was not financialisation but neoliberalisation pressures that set in motion these transformations. Of particular relevance for our purposes is the radical encroachment of IP into the 'republic of science' from the 1980s onwards which would go on to transform the biopharmaceutical R&D landscape. I briefly touch on its most important junctures with the aim of supporting my claim that financialisation pressures exploited but did not initiate these changes whose origins lay instead in the neoliberal reconfiguration of the 'republic of science', in conjunction with that of the corporation discussed earlier.

State's politico-juridical powers were indispensable in creating and sustaining the conditions for the appropriation of publicly funded and hitherto freely available academic research through IPRs. The neoliberal reconfiguration of IPRs and of the border between public and private knowledge production started initially in the US in the late 1970s and reached its pinnacle with the 1995 WTO

TRIPS Agreement which subjected more comprehensively global knowledge production and circulation to private appropriation (Zeller, 2008). More important than the expanded spatial reach of IPRs has been their expanded scope which has enabled the enclosure of ever more diverse forms of knowledge previously belonging to the 'commons' (Boyle, 2003). These enclosures expanded the reach of (artificial) scarcity in the realm of knowledge, scarcity being the core function of public IP law and without which IPRs could not function as an asset.

The extension of market principles into the 'republic of science' and its (partial) disaggregation into various for-profit units was driven by the distinct market epistemology logic of neoliberalism and not financialisation. As neoliberalism scholars have argued, the existence of academic science freely shared and insulated from market forces was an anathema to neoliberal thinkers and policymakers for which a solution came in the shape of market-driven science (Nik-Khah, 2014; Tyfield, 2016). The 1980 US Bayh-Dole Act in particular, and national variations on its theme elsewhere, were instrumental in enabling the penetration of private IPRs into the publicly funded research realm (Jasanoff, 2005). In the life sciences, the 'science-for-sale' spin-off firms that emerged had a hitherto unknown profile: relatively small, colonised by venture capital and boasting astonishingly high valuations in stock markets often without ever developing a product or making a profit (Coriat et al., 2003). For the first time in history, their valuation was based exclusively on IPRs that increasingly came to enclose both research tools and outcomes. The more pharmaceutical corporations became entangled with biotech companies through M&As and other strategies from the 1980s onwards (more below), the greater the use and accumulation of IPRs in the sector, and the more profound the reorganisation of the entire R&D process therein.

The neoliberal reconfiguration of IPRs and of the corporation itself have led to the total reorganisation of the pharmaceutical value creation process in general and R&D in particular. Although R&D was internationalised early on, it was kept in-house in relatively robust labs that would be decimated in the lab 'bloodbath' that started in the early 2000s (Mirowski, 2011). Data suggests that the trend of R&D migration was already in motion in the 1980s, but only around 4% of the large pharmaceutical corporations' R&D budget went outside in-house labs in the mid-1990s (Ramirez and Tylecote, 1999: 16). The change is pronounced from the early 2000s onwards, corresponding to the evisceration of in-house labs: around 25 percen of pharmaceutical corporations' R&D budget went to external sources in the mid-2000s (Nightingale and Mahdi, 2006: 103) and continued unabated thereafter: up to 80 percent of pharmaceutical corporations' R&D pipeline *projects* now come from external sources (Gassman et al., 2018: 82, 91). This trend intensified further during the Covid-19 pandemic (Deloitte, 2021: 11).

Apart from the rise of 'science-for-sale' firms, the neoliberal reconfiguration of knowledge production also led to the research programme in life sciences shifting away from one determined by academic experts independently of market values towards one concerned with commercial opportunities and, especially, accumulating IPRs (Mirowski, 2011). As scientific production came to increasingly rely on the multiplication of IPRs as the main means of guaranteeing rents, the classical justification of IPRs as incentives for innovation – already irrelevant in publicly funded research – was replaced by the neoliberal logic of IP as a means of creating markets for knowledge and for its efficient exploitation (Orsenigo et al., 2006). Indeed, knowledge enclosed within IPRs circulates in its own rapidly growing markets.[6] These markets both help to fuel an IP 'gold rush' penetrating deeper into the knowledge commons, and increase IP titles' prices, contributing ultimately to the higher value of IP assets controlled by the largest biopharmaceutical corporations.

Despite all this, it would be too limiting to suggest that these are solely IP-leveraging corporations. IP assets constitute a significant proportion – but not all – of pharmaceutical corporations' intangible assets. Likewise, IP rents are significant but other intangible asset rents exist of which, as

it will be seen, *network rents* are a crucial category. But this is not all. Selective disintegration is favoured by pharmaceutical corporations also because it allows them to penetrate more deeply into existing knowledge commons. Modalities of access differ; sometimes, as in the case of 'crowd-sourcing' (below), knowledge is not enclosed in a clearly defined asset form and is all the more dynamic for that reason. In other cases, the ever-growing connections between pharmaceutical corporations and bioscience innovation clusters allow these corporations to leverage not only the heterogenous kinds of knowledge generated and concentrated therein, but also the very sources that underpin their success, namely, the public goods/provisions in the region in question (Cooke, 2006). These are largely the reasons why I refer to them as knowledge-leveraging corporations.

Knowledge as a concept is fiendishly difficult to define; minimally, unlike data and information that are collected/transferred as something new, knowledge enjoys a higher degree of organisation, validity and employability (Reitz, 2017). It is creative and driven by meaning and understanding: without the application of knowledge, information is meaningless (Cooke, 2006). For our purposes, *the knowledge being leveraged is predominantly of three kinds*: the scientific and technological knowledge often (but not always) enclosed within IPRs; the knowledge specific to controlling and orchestrating the R&D and production networks; and knowledge of the complex national and global regulatory systems pertaining to the sector. Because the latter has always been important to proprietary pharmaceutical corporations, it is the other two kinds that are of particular importance to the new corporate form, although it bears noting that the growth of the global pharmaceutical market and its concentration in the hands of fewer corporations has made their control over this kind of knowledge an even more important source of rent than before.

Although not common, networks can be conceptualised *as knowledge*; Kogut (2000) is particularly convincing in arguing that networks arise out of generative rules of coordination that gradually become encoded in persisting structures (i.e. knowledge) that influence subsequent behaviour. Just as the scarcity value of coordination within firms generates rents, networks as the outcome of generative rules of coordination also generate rents. How network rents are captured or distributed is another matter. Durand and Milberg (2020) provide a good account of rents from networks where intangible assets are unequally distributed. Specifically, they group sources of network rents into: (1) tighter IPRs over technologies, standards and brands (already discussed); (2) 'natural' monopoly dynamics arising from network externalities, that is, both from the complementarity between the firms involved and the scalability and sunkness of the integration framework that makes the operation of the network possible (a framework often controlled by the most powerful firms); (3) the difference in scale economies between intangible and tangible assets (the nearly infinite returns to scale characteristic of intangible assets mean those controlling these benefit disproportionally from network expansion); and (4) innovation advantages arising to dominant companies from heightened control over network activities and over data generated in it.

All these partially overlapping sources of rent – legal rents, 'natural' monopoly rents, intangibles-differential rents, and data-driven innovation rents, respectively – are important to pharmaceutical corporations that control the new spatial organisation in research, development and production networks. This organisation has a perpetuating dynamic of its own: the more large corporations are able to extract these kinds of rents, the less they need to invest in productive and R&D capacities. Key elements of this spatial reorganisation will be discussed below, separating high-end (upstream) and lower-end (downstream) R&D mainly because they involve distinct activities (lab-based discovery and clinically based development, respectively). Because bio/pharmaceutical innovation is not generally process-embedded, innovation and production networks are often separate but both tightly controlled by lead companies (Buciuni and Pisano, 2021).

Less attention is paid to the production network for this and other reasons that will become clear shortly.

Upstream research and development

The neoliberal reconfiguration of the corporation and of scientific knowledge production was instrumental in the collapse of the in-house lab in the sector, as well as in the rise of 'science-for-sale' firms and 'entrepreneurial' public research institutes in the life sciences. The days of in-house R&D labs as the main engines of company growth appear to be over: more than half of new drugs introduced in the US by the end of the first decade of the new century originated from public laboratories and small firms rather than pharmaceutical corporations (Kneller, 2010). More importantly, perhaps, R&D spending has *fallen* by 1–2 percent annually in real terms since 2010 (Scannell et al., 2015) amid shareholders' concern that the internal rate of return on R&D investment is lower than the industry cost of capital (Deloitte, 2021).

In practice, these changes manifested themselves in the gradual shift away from (re)producing resources in-house to continuously obtaining new ones from outside, which is why acquisitions remain an important way for pharmaceutical corporations to replenish anaemic drug pipelines and/or bring in-house strategic assets. In a vortex of reinforcing dynamics, the more in-house labs have disintegrated, and the more corporations have become buyers of firms with promising pipelines that depend on their IP portfolios for their valuations, the more expensive their acquisitions have become (Sunder Rajan, 2017: 42). Nevertheless, the migration of various aspects of drug discovery to other firms offers large corporations an attractive and cost-effective way of reducing their R&D outlays through monitoring new R&D efforts financed by others. This cost-benefit calculation works largely in their favour because they are the only players with the necessary resources to introduce new drugs in an increasingly complex global pharmaceutical market. This dominant market position enables them to leverage innovation across networks in line with their priorities, a dynamic that further enhances their dominance (Buciuni and Pisano, 2021; Rikap and Flacher, 2020).

Acquisitions aside, a plethora of network relationships has also proliferated (Gassman et al., 2018). Licensing deals of ever more complex forms and increasing value have experienced a phenomenal growth, followed by other types of deals, including various kinds of alliances, joint-ventures, co-development deals, partnership with universities, and, to a lesser extent, out-licensing. New ways of leveraging knowledge have emerged, e.g. 'crowdsourcing', aimed at solving a pre-defined problem by harnessing the collective cognitive surplus residing in a 'global brain pool' unconnected to the corporation (Bentzien et al. 2015). Venture funding – equity investments in promising biotech firms using pharmaceutical companies' own venture investment arms – has likewise grown rapidly, further blurring the financial/non-financial boundaries of their daily activities. That said, *virtual* pharmaceutical companies that execute R&D projects largely through global, on-demand external resources are not the order of the day: most pharmaceutical corporations have so far retained certain core elements of their R&D functions. But, importantly, what remains in-house is deeply imbued with the neoliberalisation-financialisation logics: R&D has largely become about managing what activities remain inside/outside the ever more porous company boundaries, a decision taken using portfolio management techniques originating in the financial sector (Gassman et al., 2018).

The integrating and disintegrating effects of the two key R&D strategies adopted by pharmaceutical companies – acquisitions and networking, respectively – continuously fuel the *concentration-decomposition* dynamic observed earlier. Both acquisitions of, or networks with, external partners are driven by the imperative of accumulating intangible assets as key mechanisms

for appropriating knowledge developed in other firms, public institutions, and, more broadly, society on the one hand, and converting them into rents on the other. Reliance on these two strategies, in turn, further propels external partners to enclose various knowledge services into more specialised knowledge packages in an effort to satisfy large coporations' vociferous appetite for them (Gassman et al., 2018). The label 'open innovation networks' often given to these R&D networks, like that of 'goodwill', conceals what drives them, namely, secrecy, aggressive use of IP, and, above all, *control*. These networks are, in other words, organisational means through which corporations continue to maintain control over and tightly coordinate R&D processes in the network (Buciuni and Pisano, 2021; Rikap, 2021).

Put simply, large pharmaceutical corporations today are predominantly concerned with leveraging external innovation so as to generate higher R&D returns with reduced costs. Their transformation into knowledge-leveragers enables them to effectively 'veto' the kinds of R&D network outputs reaching the market, namely, those with the highest future earnings' growth potential (Rikap, 2019). Consequently, the most important issues in the increasingly complex R&D arrangements relate to IP, royalties, exclusivity, and the like; indeed, while the complexity of in-house R&D has diminished, that of managing and coordinating relations with various partners has increased dramatically (Gassman et al., 2018), which is why the network's integration framework should be considered as an intangible asset on its own right.

Spatially, these power dynamics have generated networks that are rather concentrated, held together by pharmaceutical corporations at the helm. The imperative of accumulating and controlling knowledge assets, on the one hand, leads corporations to penetrate deeper into the social context of spatially concentrated innovation systems in particular so as to acquire – freely or comparatively cheaply – knowledge located therein; on the other, the control imperative favours hierarchical and intensive/short network links (Buciuni and Pisano, 2021; Zeller, 2008;). An unsurprising outcome of this spatial organisation is the strengthening of already strong bioscience innovation clusters. Their heavy reliance on public goods/provisions in the form of universities, research hospitals, public grant-giving bodies and so on, enables them to 'irrigate the environment' with knowledge spillovers (Cooke, 2006) which pharmaceutical corporations increasingly appropriate (Rikap, 2019; Rikap and Flacher, 2020; Zeller, 2010). The San Diego and Massachusetts genomics research cluster, for instance, was penetrated by Novartis early on, initially thanks to a deal that gave it first refusal rights over a good share its research outputs, followed by the establishment of a research institute in Massachusetts (Zeller, 2002). These deals are now common currency.

Downstream research and development

The emergence of the hitherto unknown science-for-sale firms in upstream R&D in the 1980s was coupled with that of the 'contract research organisations' (CROs) in the downstream part. The neoliberal knowledge production restructuring tore clinical research out of university hospitals and academic institutions, too; their rhythms and rationalities came increasingly in conflict with the nature of marketised science outputs upstream and with pharmaceutical corporations' preference for downstream drug development that generated the outcomes needed for drug approval as quickly and cost-effectively as possible (Mirowski, 2011). Initially small and with a narrow remit, CROs have grown into diversified firms that can offer service packages along the entire range of drug development and clinical trial management activities worldwide; data is hard to secure, but it is estimated that CROs conduct over 70% of industry's clinical trials (Sismondo, 2017).

The neoliberal extension of market principles into this part of R&D previously handled in-house and/or academic institutions has not only created a buoyant market, but also altered the kind of knowledge generated. Indeed, the epistemological consequences of the transformation of bio/pharmaceutical R&D in the neoliberalisation-financialisation nexus have been profound. Upstream, the salience of private appropriation via IPRs and associated rents has substantially narrowed down the kind of research questions and methodologies that get pursued, as priority is given to biopharmaceutical knowledge that is suitable to IP-appropriation, often unitary objects with stable and predictable properties (Calvert, 2008; Scannell et al., 2012). Such epistemological narrowing continues downstream. As CRO's *raison d'être* is to subject (preferably all) scientific functions previously performed by the academic clinician to the market logic, useful knowledge unrelated to the trial, serendipity, and even patient health outcomes are sacrificed in pursuit of data packages that meet pharmaceutical companies' drug approval timelines and control imperatives (Scannell et al., 2012).

The knowledge generated downstream is not only much narrower in scope, but, importantly, subordinated to the large corporations' rent-extraction logic: highly standardised, depersonalised and delocalised data regarding drug regimes and effects are packaged so as to maximise corporations' control over data confidentiality and IPRs other than patents, especially *data exclusivity* (Mirowski, 2011). This logic of control and rent extraction penetrates all aspects of downstream R&D: drug trial methodologies have been transformed in terms of lines of research pursued, experiment design, data gathering and packaging, followed by the strategic interpretation and disclosure of such clinical data by CROs. The latter function is often carried out by the so-called 'publication planners' managed by pharmaceutical companies' marketing departments whose job is to time publications to achieve maximum commercial impact (Sismondo, 2017). In short, the 'veto power' large corporations exert over R&D networks necessarily extends to downstream R&D functions, for it is their control over the entire R&D network that enables them to extract value generated there relatively inexpensively (Durand and Milberg, 2020; Zeller, 2010).

Production

Complex layers of control orchestrated by large corporations confound efforts to depict the transformed R&D activities schematically. The complex interplay between the kind of candidates generated by the restructured upstream R&D and that of clinical knowledge generated downstream rejects modular depictions. Moreover, although value chain depictions are used to illustrate junctures where value is predominantly extracted in this sector (Buciuni and Pisano, 2021; Haakonsson, 2009;), it is not always easy to fit production neatly in them. The imperative of reducing the labour and physical/productive footprint, noted above, naturally extends to production activities and, as in many other sectors, they have progressively been performed by firms of different sizes and specialisation across the world. These pressures, and their outcomes, manifest themselves similarly in different sectors, this being the main reason why limited attention is dedicated here to the restructuring of proprietary drug production processes.

Nevertheless, cost imperatives are not the only, or even the most important, determinants of how production processes are organised: as in the case of R&D, *control* over knowledge is central to such organisation. *Trade secrets* related to manufacturing processes, for instance, are crucial in the bio/pharmaceutical sector, in many cases a more effective form of IPR than patents (Price and Rai, 2016). This is especially so in the case of biologics which are gradually replacing small molecule drugs' lead position in the market; here, the final product is highly sensitive to a specific production pathway which, in turn, is a trade secret, an intangible asset sanctioned by IP law. More generally,

the imperative of control over knowledge means that some production activities remain in-house or are hierarchically arranged (e.g. through FDI), while others are arms-length, usually carried out by globally orientated Contract Manufacturing Organisations (CMOs). This is why the production of therapeutic agents, a knowledge- and capital-intensive process, is concentrated in a few locations, whereas the galenical production of pharmaceutical drugs, a labour-intensive one, is dispersed more widely (Zeller, 2010).

The global production map in the sector is complicated not only by the vast array of CMOs and their subcontractors vying for business, but also by the fact that CROs, noted above, have progressively expanded to provide manufacturing services. Moreover, production partnerships and licenses also depend on the capabilities of manufacturers in meeting highly technical and rather strict certification and other regulatory standards; even when production processes have been fully outsourced, lead companies remain actively involved in their suppliers' activities through production process codification and quality control (Buciuni and Pisano, 2021). Capillary control over knowledge and activities in production networks, whether through hierarchical or captive governance mechanisms on the part of lead companies, is the predominant feature of these networks. It is this imperative of control that largely determines the spatial organisation of production networks. Producing drugs in qualities and timeframes deemed important by health authorities cannot be expected from a network thus organised.

Some concluding thoughts

Pharmaceutical shortage lists in developed and developing countries alike, accompanied by an R&D productivity crisis manifested in fewer innovative drugs compared to historical trends, are only two outcomes of a radically transformed pharmaceutical sector. The vertically integrated company of old has been replaced by the selectively 'disintegrated' company of today, at the helm of research, development, and production networks and orientated predominantly towards the large-scale extraction of knowledge rents. We have seen that both the roots of pharmaceutical corporations' disintegration, so central to their wider/deeper penetration of valuable socio-economic processes, and the roots of their increased market power, so central to their value extraction from therein, are to be found in the co-constitutive processes of neoliberalism and financialisation. It is difficult to grasp the depth of these transformations but through this nexus. From this vantage point, the knowledge-leveraging corporations are more profitable and powerful today precisely because these two co-constitutive phenomena have enabled them to expand such penetration and control to levels unknown in the history of the sector.

Space constrains have limited the consideration of the many social, economic and political consequences of the transformations discussed here. A good starting point would be to investigate knowledge-leveraging corporations as tools for siphoning off value from the social and productive sphere in light of their nature as *social institutions*. It is one of the biggest ironies of the current juncture that the more large corporations have 'decomposed' and the more they rely on their control over networks to penetrate more deeply knowledge embedded in economy and society, the scarcer references to them as social institutions have become. Seeing them as social institutions would create the necessary space for thinking differently both about the roots of their recent transformations and about strategies for dealing with the aftermath. In the absence of alternative ways of 'seeing', thinking, and acting, the risk remains that the more pharmaceutical corporations proceed in their transformation into knowledge-leveragers, the more they will perpetuate the neoliberalisation-financialisation dynamic in the sector, all the while making their own future – and that of the millions who depend on them – more unstable and insecure. Indeed, whatever the promises of

neoliberalisation and financialisation for the sector, they appear to have been the disease masquerading as the cure.

Declaration of conflicting interests

The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

Funding

The author(s) disclosed receipt of the following financial support for the research, authorship, and/or publication of this article: Work on the final version, however, benefitted from the author's stay at the Swedish Collegium for Advance Study as a Senior Global Fellow.

ORCID iD

Valbona Muzaka https://orcid.org/0000-0002-3268-9506

Notes

1. The term used widely in the literature to distinguish what once were large, research-based, pharmaceutical companies reliant on proprietary IP titles such as patents from other, most notably generic, companies.
2. This is perhaps uncontroversial; the Financial Accounting Standards Board recognises intangible assets related to supplier relationships under the contract-based category of SFAS 142 (Statement of Financial Accounting Standards no. 142 *Goodwill and Other Intangible Assets*).
3. Ballance et al. (1992) report a value of US$ 70 billion in 1975 (in 1980 dollars), around US$225 billion in 2018 dollars (own calculation); the 2018 market value reported in IQVIA (2019) was US$1.2 trillion.
4. Danzon et al. (2003) and Busfield (2020).
5. Own calculations based on PATSTAT data.
6. For example, charges for the use of IPRs increased 40 times between 1980 and 2018 (BoP, current US$), according to the World Bank Indicators website, https://data.worldbank.org/indicator/BX.GSR.ROYL.CD

References

Alchian A and Demsetz H (1972) Production, information costs, and economic organization. *The American Economic Review* 62(5): 777–795.

Andersson T, Gleadle P, Haslam C, et al. (2010) Bio-pharma: a financialized business model. *Critical Perspectives on Accounting* 21: 631–641.

Auvray T, Durand C, Rabinovich J, et al. (2021) 'Corporate Financialization's Conservation and Transformation'. *Review of Evolutionary Political Economy* 2: 431–457.

Baars G and Spicer A (eds) (2017) *The Corporation: A Critical, Multi-Disciplinary Handbook*. Cambridge: Cambridge University Press.

Ballance R, Pogany J, Forster H, et al. (1992) *The World's Pharmaceutical Industries*. Aldershot: Edward Elgar.

Baranes AI (2020) Intangible assets and the financialized business enterprise. *Journal of Economic Issues* 54(3): 692–709.

Bentzien J, Bharadwaj R and Thompson DC (2015) Crowdsourcing in pharma: a strategic framework. *Drug Discovery Today* 20(7): 874–883.

Birch K (2020) Technoscience rent: toward a theory of rentiership for technoscientific capitalism. *Science, Technology & Human Values* 45(1): 3–33.

Birch K and Muniesa F (eds) (2020) *Assetization: Turning Things into Assets in Technoscientific Capitalism*. Cambridge: MIT Press.

Bourgeron T and Geiger S (2022) (De-)assetizing pharmaceutical patents. *Economy and Society* 51(1): 23–45.

Boyle J (2003) The second enclosure movement and the construction of the public domain. *Law and Contemporary Problems* 66(1 and 2): 33–74.

Bryan D, Rafferty M, Wigan D, et al. (2022) "Intangible capital" in Seabrooke. In: Seabrooke L and Wigan D (eds) *Global Wealth Chains*. Oxford: Oxford University Press.

Buciuni G and Pisano G (2021) Variety of innovation in global value chains. *Journal of World Business* 56: 1–13.

Busfield J (2020) Documenting the financialisation of the pharmaceutical industry. *Social Science & Medicine* 258: 113096.

Calvert J (2008) The commodification of emergence: systems biology, synthetic biology and intellectual property. *BioSocieties* 3: 383–398.

Christophers B (2020) *Rentier Capitalism*. London: Verso.

Ciepley D (2013) Beyond public and private: toward a political theory of the corporation. *American PS Review* 107(1): 139–158.

Cooke P (2006) Global bioregions. *Industry and Innovation* 13(4): 437–458.

Coriat B and Orsi F (2002) Establishing a new intellectual property rights regime in the United States. *Research Policy* 31(8/9): 1491–1507.

Coriat B, Orsi F, Weinstein O, et al. (2003) Does biotech reflect a new science-based innovation regime? *Industry & Innovation* 10(3): 231–253.

Danzon P, Epstein A and Nicholson S (2003) *Mergers and Acquisitions in the Pharmaceutical and Biotech Industries*. Cambridge, MA: NBER. Working Paper 10536.

Davies W (2010) Economics and the 'nonsense' of law: the case of the Chicago antitrust revolution. *Economy and Society* 39(1): 64–83.

Deloitte (2021) Report. *Seeds of Change: measuring the return from pharmaceutical innovation*. UK: Deloitte.

Drucker PF (1972) *The Concept of the Corporation*. New York: John Day Co. 1946.

Durand C and Milberg W (2020) Intellectual monopoly in global value chains. *RIPE* 27(2): 404–429.

Epstein G (2005) *Financialization and the World economy*. Cheltenham and Northampton: Edward Elgar.

European Parliament (2020) Report on the shortage of medicines: how to address and emerging problem. https://www.europarl.europa.eu/doceo/document/A-9-2020-0142_EN.html#_section4

Fernandez R and Klinge T (2020) *Private Gains We Can Ill Afford, Working Paper*. The Netherlands: The Centre for Research on Multinational Corporations.

Gagnon M-A (2007) Capital, power and knowledge according to thorstein veblen: reinterpreting the knowledge-based economy. *Journal of Economic Issues* 41(2): 593–600.

Gassman O, Schuhmacher A, von Zedtwitz M, et al. (2018) *Leading Pharmaceutical Innovation*. 3rd edition. Cham, Sw: Springer.

Haakonsson S (2009) The changing governance structures of the global pharmaceutical value chain. *Competition and Change* 13(1): 75–95.

Hogarth S (2015) Neoliberal technocracy. *Social Science and Medicine* 131: 255–262.

IQVIA (2019) The Global Use of Medicine in 2019 and Outlook to 2023. The IQVIA Institute for Human Data Science.

Ireland P (1999) Company law and the myth of shareholder ownership. *The Modern Law Review* 62(1): 32–57.

Işik E and Orhangazi Ö (2022) 'Profitability and Drug Discovery'. *Industrial and Corporate Change* 31: 891–904.

Jasanoff S (2005) *Designs On Nature: Science and Democracy in Europe and The United States*. Princeton: Princeton University Press.

Jessop B (2013) Putting neoliberalism in its time and place: a response to the debate. *Social Anthropology* 21(1): 65–74.

Kneller R (2010) The importance of new companies for drug discovery: origins of a decade of new drugs. *Nature Reviews Drug Discovery* 9: 867–882.

Kogut B (2000) The network as knowledge: generative rules and the emergence of structure. *Strategic Management Journal* 21: 405–425.

Langley P (2020) Assets and assetization in financialized capitalism. *Review of International Political Economy* 28(2): 382–393.

Lazonick W (2015) *Stock Buybacks: From Retain-and Reinvest to Downsize-and-Distribute*. Washington DC: The Brookings Institution Centre for Effective Public Management.

Lazonick W, Hopkins M, Jacobson K, et al. (2017) US pharma financialized business model. New York: Institute for New Economic Thinking. Working Paper Series 60.

Mirowski P (2011) *ScienceMart: Privatizing American Science*. Cambridge, MA: Harvard University Press.

Montalban M and Sakinç M (2013) Financialization and productive models in the pharmaceutical industry. *Industrial and Corporate Change* 22(4): 981–1030.

Muzaka V (2011) *The politics of intellectual property rights and access to medicines*. Basingstoke: Palgrave MacMillan.

Nightingale P and Mahdi S (2006) The evolution of pharmaceutical innovation. In: Mazzucato M and Dosi G (eds) *Knowledge Accumulation and Industry Evolution*. Cambridge: Cambridge University Press.

Nik-Khah E (2014) Neoliberal pharmaceutical science and the Chicago school of economics. *Social Studies of Science* 44(4): 489–517.

Orsenigo L, Dosi G and Mazzucato M (2006) The dynamics of knowledge accumulation, regulation, and appropriability in the pharma-biotech sector. In: Mazzucato M and Dosi G (eds). *Knowledge Accumulation and Industry Evolution*. Cambridge: Cambridge University Press.

Pagano U (2014) The crisis of intellectual monopoly capitalism. *Cambridge Journal of Economics* 38: 1409–1429.

Peck J (2010) *Constructions of Neoliberal Reason*. Oxford: Oxford University Press.

Pisano G (2012) The evolution of science-based business. In: Lazonick W and Teece DJ (eds) *Management Innovation: Essays in the Spirit of Alfred D. Chandler, Jr.* Oxford: Oxford University Press.

Price N and Rai A (2016) Manufacturing barriers to biologics competition and innovation. *Iowa Law Review* 101: 1023–1064.

Ramirez P and Tylecote A (1999) *Technological Change in the Pharmaceutical Industry. COPI Report Prepared for EC DGXII*. Sheffield, UK: Sheffield University.

Reitz T (2017) In: Werlen P, Werlen B and Suarsana L (eds) 'Pragmatic philosophy and the social function of knowledge' in Meusburger. In: *Knowledge and Action*. London: Springer.

Rikap C (2019) Asymmetric power of the core: technological cooperation and technological competition in the transnational innovation networks of big pharma. *Review of International Political Economy* 26(5): 987–1021.

Rikap C (2021) *Capitalism, Power and Innovation*. London: Routledge.

Rikap C and Flacher D (2020) Who collects intellectual rents from knowledge and innovation hubs? *Structural Change and Economic Dynamics* 55: 59–73.

Rogers S (2023) 'The Emergence of the Rentrocrat'. *New Political Economy* 28: 1. DOI: 10.1080/13563467.2023.2172148

Roy V (2020) A crisis for cures? In: Birch K and Muniesa F (eds) *Assetisation: Turning Things into Assets*. Cambridge, MA: MIT Press.

Sawyer M (2013) What is financialization? *International Journal of Political Economy* 42(4): 5–18.

Scannell JW, Hinds S and Evans R (2015) Financial returns on R&D: looking back at history, looking forward to adaptive licensing. *Review on Recent Clinical Trials* 10: 28–43.

Schwartz H (2016). "*Wealth and Secular Stagnation" The Russell Sage Foundation Journal of the Social Sciences* 2(6): 226–249.

Schwartz H (2022) Global secular stagnation and the rise of intellectual property monopoly. "*Global Secular Stagnation and the Rise of Intellectual Property Monopoly" RIPE* 29(5): 1448–1476.

Sell S (2003) *Private Power, Public Law: The Globalization of Intellectual Property Rights*. Cambridge: Cambridge University Press.

Sismondo S (2017) Hegemony of knowledge and pharmaceutical industry strategy. In: Ho D (ed) *Philosophical Issues in Pharmaceutics. Philosophy and Medicine*. Dordrecht: Springer.

Sunder Rajan K (2017) *Pharmocracy: Value, Politics, and Knowledge in Global Biomedicine*. London: Duke University Press.

Texeira R and Rotta T (2012) *'Valueless Knowledge-Commodities and Financialization' Review of Radical Political Economics* 44(4): 448–467.

Tulum Ö and Lazonick W (2018) Financialized corporations in a national innovation system: the U.S. Pharmaceutical industry. *International Journal of Political Economy* 47(3-4): 281–316.

Tyfield D (2016) 'Science, innovation and neoliberalism'. In: Springer S, Birch K and MacLeavy J (eds) *The Handbook of Neoliberalism*. London: Routledge.

Us FDA (2013) *Strategic Plan for Preventing and Mitigating Drug Shortages, US Food and Drug Administration*. https://www.fda.gov/media/86907/download

van Horn R (2018) Corporations and the rise of Chicago Law and Economics. *Economy and Society* 47(3): 477–499.

Vercelli A (2013) Financialization in a long-run perspective. *International Journal of Political Economy* 42(4): 19–46.

Zeller C (2002) 'Regional and North Atlantic knowledge production in the pharmaceutical industry'. In: Lo V and Schamp E (eds) *Knowledge: The Spatial Dimension*. Münster: Verlag.

Zeller C (2008) From the gene to the globe: extracting rents based on intellectual property monopolies. *Review of International Political Economy* 15(1): 86–115.

Zeller C (2010) The pharma-biotech complex and interconnected regional innovation Arenas. *Urban Studies* 47(13): 2867–2894.