

# The Entrepreneurial State and public options: Socialising risks and rewards

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# The Entrepreneurial State and public options: Socialising risks and rewards

Mariana Mazzucato\* and Henry Lishi Li\*\*

## Abstract

This paper reflects on recent policy thinking on public options by looking at the role of the state — and economic policy — in modern capitalism. In traditional economic theory, the state is limited to 'fixing markets' and 'enabling' or de-risking the private sector. These assumptions are based on a limited understanding of value creation as something that only happens within the private sector. Value is understood as being enabled or redistributed by the state, but not co-created by it. And yet the state has often actively co-shaped markets, investing, innovating and taking high risks before the private sector is willing or able to. Understanding the market shaping and co-creating role of the state — beyond the fixing role — requires looking at how both risks and rewards can be shared between public and private actors. Public options, among other approaches such as equity stakes and conditionalities on reinvestment, are a powerful way to enable the state to govern public-private relationships to make sure that public investment delivers for the public interest.

**Keywords:** Government policy, regulation, public health, public policy, industrial policy, sectoral planning methods, drugs, innovation and invention, technological change, intellectual property and intellectual capital

**JEL codes:** B00, I18, H00, L38, L52, L65, O31, O32, O33, O34, O38

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## 1. Introduction

The concept of a public option — a good or service that is government-provided, quality-assured and universally available at a reasonable and fixed price, which coexists with products from the private sector — is receiving increasing interest as a public policy tool (Sitaraman and Alstott 2019). The idea can be applied to a range of social and public services, such as health care, retirement, higher education, banking and childcare. It can also be applied to innovation and manufacturing, especially in the pharmaceutical industry and with regard to issues that matter to citizens (access to health, clean energy, and the benefits of big data and AI). Indeed, the use of public options for sectors driven by fast innovation is developing into an exciting new area of policy.

More recently, growing interest in the public sector playing a greater role in pharmaceutical innovation and manufacturing is, in part, due to the impasse in the existing innovation system and the difficulty it has pivoting towards addressing some of the greatest public health crises of our time — from the slow-burning problem of antibiotic resistance to the fast-moving emergency of the COVID-19 pandemic. While the pharmaceutical sector receives billions in public-sector investment (e.g. in the US alone the National Institute of Health (NIH) invests over \$40 billion a year — see Section 2), the structure of supply, patents, pricing and access does not sufficiently enable the state to govern the benefits for the public interest. In particular, the direction of the innovation (what types of diseases are focussed on) and the way the innovation system itself is governed (e.g. the way that intellectual property rights (IPR) are structured — too upstream, too wide and too strong) hurts the public (Mazzoleni and Nelson 1998).

The main criticisms of public options concern the relationship between public and private sectors in the economy, especially the role of government in the direct provision of goods in the market — the risk of ‘crowding out’ the private sector (Mazzucato and Penna 2016), as well as the underlying capability and capacity of governments for implementation and delivery (Kattel and Mazzucato 2018). Fundamentally, the criticisms centre on the assumption of a clear divide between public and private sector, and the view that public-sector contribution to economic activities should remain minimal and be confined to simply fixing markets, ‘regulating’ and levelling the playing field (Mazzucato 2016).

This paper frames public options as a broader policy vehicle that has an application not just for socioeconomic reasons (classic public good arguments), but also for technological change and dynamism. In doing so, it situates public options within a broader economic theory of value creation by the state (Mazzucato 2013; Mazzucato 2018a). We argue that the contribution to value creation by different parts of the public sectors has been theorised in problematic ways that understate the contribution of the state while overstating the contribution of other actors, with consequences for the overall distribution of rewards. In other words, while the creation of value is collective, its distribution is not. This has also meant that the full potential of the state to drive both innovation-led and inclusive growth has not been realised.

This paper argues that a better understanding of the role that the state has and can play in the wealth-creation process is the starting point for policy solutions that can increase the rate of wealth creation, while reducing rent-seeking and ensuring a fairer distribution of that co-created

wealth. Meeting the challenge of inequality requires less a redistributive state and more an *entrepreneurial state* (Mazzucato 2013; Laplane and Mazzucato 2020) or, as Rodrik has argued, shifting the focus from a 'welfare state to an innovation state' (Rodrik 2015). This is the way to create innovation-led growth that is also more inclusive growth. Seen in this light, public options are an important and proactive instrument to deliver public rewards in return for the state's risk-taking in innovation, and a tool that can foster public-sector capabilities in innovation and manufacturing in the direction of addressing societal missions.

The paper is organised as follows. Section 2 reviews the economic and political thinking behind the depiction of the state as simply a market-fixer. It also looks at the role that public choice theory has had in focusing on *government failure* as an even greater problem than market failure. Section 3 presents an alternative view of the state as market-maker, drawing on the work of Polanyi and Keynes, as well as the neo-Schumpeterian literature that has emphasised the role of public investments in driving innovation, not just facilitating it. This section concludes with examples of public-sector wealth creation. Section 4 looks at the other side of the coin: government investments that have led to failures. In doing so, it considers the need to understand failure in two ways: (1) as part and parcel of the investment and innovation process; and (2), failure that arises from instances where the state is captured by vested interests, which make money simply by moving around existing wealth, not creating new wealth. In cases where the public sector is not captured and is producing new value, Section 5 considers how that value might be better distributed if it is understood as having arisen from a collective co-creation process where the tax-payer has also played a lead role. Based on the arguments set out in the previous sections and the examples outlined in Section 5, Section 6 examines public options as a market-shaping policy that delivers public rewards, using the pharmaceutical sector as a main example. Section 7 discusses the central role of public ownership in the policy instruments proposed. Section 8 concludes

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## **2. The state as market-fixer**

Key to the problem is that in economic theory the state is, at best, seen as facilitating the process of wealth creation, but not being a key driver of the process itself. In microeconomics, it is seen as *fixing* markets, not creating them. In industrial-innovation economics, its role is limited to spending on public goods, such as science or infrastructure, and de-risking the activities of innovators, and does not extend to being an innovator itself. In macroeconomics, it is seen as fixing the business cycle and as a lender of last resort. It is not seen as a lead risk-taker across the business cycle or an *investor* of first resort. And if or when a public agency does dare to make strategic choices and take risks, it is often accused of crowding out the private-sector actors or of being too inept to 'pick winners'.

This limited view of the role of the state in the dynamics of wealth creation has had three problematic effects. First, it has limited policymakers' understanding of the range of tools and instruments they have for catalysing growth, often choosing to sit on the sidelines, 'levelling' the playing field. Second, it has reduced the confidence of the public sector, making it more vulnerable to being captured by vested interests and 'rent-seeking' behaviour. Third, it has increased

inequality by allowing some actors to exaggerate their role in creating wealth and extract value well beyond their contribution to its creation.

The idea that the state is, at best, a fixer of markets has its roots in neoclassical economic theory, but this view has hardened in recent years as a result of an ideological political project against the state. We review both perspectives briefly.

Based on Arrow's first fundamental theorem of welfare economics (Arrow 1962), when markets are complete, competitive and operating in equilibrium, they are taken to be the most efficient allocators of resources. However, these conditions are rarely obtainable and five broad categories of 'market failure' that justify government 'intervention' have been identified: (1) coordination failures, including inter-temporally through the operation of the business cycle, making it difficult to coordinate expectations and preferences (Stiglitz 1974); (2) public goods such as clean air or new knowledge arising from basic research; (3) imperfect competition, whether arising from natural monopolies, network effects or economies of scale; (4) information failures leading to adverse selection, moral hazard or high transaction costs (Stiglitz and Weiss 1981; Coase 1960); and (5) negative externalities, such as traffic congestion or climate change (Stern 2007).

Government intervention is justified when any of these conditions exist.

If government is viewed as, at best, a fixer of market failures, at worst it is seen as an impediment to growth: it is inefficient; due to its natural tendency towards corruption it is constantly vulnerable to lobbying by specific business interests (Krueger 1974; Falck, Gollier and Woessmann 2011); and its actions risk crowding out private actors (Friedman 1979). In this caricature, governments are Hobbesian leviathans, sucking dry the dynamic energy of the market, and an ever-present threat to the creativity and dynamism of the private sector (Phelps 2013). Market failure is therefore a necessary but not sufficient condition for governments to act (Wolf 1988). There is a trade-off between two inefficient outcomes — one generated by markets and the other generated by 'government failures' from intervention. The benefits of acting must outweigh the costs that may arise from these risks of 'government failure' (Tullock, Seldon and Brady 2002).

In this dominant view, government's main role is to set the rules of the game and to keep them working (the rule of law); fund basic public goods such as infrastructure and education; 'level the playing field' so that industry and competition can thrive (through competition rules or support to new firms in order to compete with incumbents); and devise market mechanisms to internalise external costs (e.g. pollution) or benefits (e.g. herd immunity). If and when the public sector does more than intervene in areas characterised by market failures, it is deemed to be causing different types of problems, such as: (1) crowding out the private sector; (2) government failure due to the inability of the state to 'pick winners'; and (3) government failure due to the state's inevitable vulnerability to capture by rent-seeking private interests (Buchanan 2003).

Although scepticism about the role of government dates back to the first developments of philosophy and, later, economics, the strict modern formulation of the limits to government can be traced to the rise of New Public Management theory, which grew out of Public Choice theory in the 1980s. This perspective has been used to convince governments that the way they can be less burdensome is to emulate the private sector as much as possible (Buchanan 2003). Judt (2011) has shown how the dismantling of the welfare state, a political project that began with

Reagan and Thatcher in the late 1970s–early 1980s, co-evolved with this theoretical framework. And Jones (2014) shows how the neo-liberal agenda was underpinned by the view of the state as an inept and constantly captured entity. These trends have led to an undermining of confidence in the positive power of public institutions and an increasing outsourcing of government functions to the private sector: it is surely easier to get business to act like business than for government to do so (Crouch 2016).

This view of government also has its roots in the way that output is measured in both macro- and microeconomics. Government typically exists in macroeconomic theory, as a redistributor of the wealth that is created by companies, and an investor in some basic public goods like infrastructure, basic research and education. It normally exists only in macroeconomic models that look at the effect of regulation or investment at the aggregate level. And it is totally missing from the microeconomic *production function*, where value is created. In microeconomics, total output is understood in terms of the (marginal) productivity of labour, capital and technology inputs. The production function posits the relationship between the output that a company produces and the various inputs it uses, including labour, machinery, and technology. Yet this view disregards the enormous government inputs that have created both the human capital and the technology that enter the production function, as well as the early stage high-risk financing that innovative companies require. In essence, in standard microeconomics, government is ignored, except for its role in regulating the prices of inputs and outputs, and fixing market failures of different types.

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### **3. The state as *market-maker***

The history of capitalism tells us a different story — the story of a state that has often been responsible for actively shaping and creating markets, not just fixing them. Indeed, markets themselves should be viewed as outcomes of the interactions between both public and private actors (as well as actors from the third sector and from civil society). In his seminal work, *The Great Transformation*, Karl Polanyi (1944) describes the role of the state in forcing the so-called free market into existence: ‘The road to the free market was opened and kept open by an enormous increase in continuous, centrally organized and controlled interventionism’ (p. 144). Polanyi’s perspective debunks the notion of state actions as ‘interventions’. It is rather one in which markets are deeply embedded in social and political institutions (Evans 1995), and where markets themselves are outcomes of social and political processes. Indeed, even Adam Smith’s notion of the free market is amenable to this interpretation. His free market was not a naturally occurring state of nature, ‘free’ from government interference. For Smith the free market meant a market ‘free from rent,’ which requires much policymaking (Smith 1776).

And yet within economic theory, there is an absence of words to refer to the ways in which the actions of public institutions (visions, investments and regulations) contribute to value creation, not only its fixing-up or its distribution. Polanyi’s analysis is not only about the way that markets form over the course of economic development. It can also be applied to understanding the most modern form of markets and in particular those driven by innovation. Some of the most important general-purpose technologies, from mass production, to aerospace, and information and communications technology, trace their early investments to public-sector investments (Ruttan

2006; Block and Keller 2011). Indeed, all of the technologies which have made Apple's i-products (iPhone, iPad, etc.) 'smart' were initially funded by public-sector institutions: the Internet by the Defense Advanced Research Projects Agency (DARPA); global positioning system (GPS) by the US Navy; touchscreen display by the Central Intelligence Agency (CIA); and the voice-activated personal assistant Siri by DARPA again (Mazzucato 2013).

Key to understanding the implications of these histories is that public investments in the areas named above were not limited to simply funding 'basic' research, a typical 'public good' in market failure theory (Arrow 1962; Nelson 1959). In the US, for example, government agencies funded areas along the entire innovation chain: both basic *and* applied research and, in many cases, provided downstream early stage high-risk finance to companies deemed too risky by the private financial sector.

For example, in its early years, Apple received \$500,000 from the Small Business Investment Corporation, a financing arm of the US government (Audretsch 2003). Likewise, Compaq and Intel received early-stage funding to set up their companies, not from venture capital but from the public Small Business Innovation Research (SBIR) programme. This programme has been particularly active in providing early-stage finance to risk-taking companies — more so than private venture capital (Keller and Block 2013). Indeed, while it is a common perception that it is private venture capital that funds start-ups, evidence shows that most high-growth innovative companies receive their early-stage high-risk finance from public sources, such as Yozma in Israel (Breznitz and Ornston 2013); venture funds in public banks (Mazzucato and Penna 2016); and the SBIR programme funds in the US (Keller and Block 2013). Although venture capital entered the biotech industry in the late 1980s and early 1990s, all the heavy investments in this sector occurred in the 1950s, 1960s and 1970s — and were mostly made by the state (Lazonick and Tulum 2011; Vallas, Kleinman and Biscotti 2011). The NIH is the biggest early investor in biopharmaceuticals. Since 2000, it has invested close to \$750 billion (in 2020 dollars) in the biotech-pharma knowledge base and \$41.7 billion in 2020 alone.<sup>1</sup> NIH funding contributed to every one of the new molecular entities approved from 2010 to 2016 and previous studies have shown that it contributes to therapeutic advances that are truly innovative and impactful to human health. Between 1988 and 2005, 17.4 percent of patented new drugs approved by the US Food and Drug Administration (FDA) that underwent priority review — the most innovative drugs — had public-sector patent; 64.5 percent of priority-review new drugs and 47.8 percent of all new drugs cited either a public-sector patent or a government publication (Sampat and Lichtenberg 2011). New drugs and vaccines approved by the FDA between 1970 and 2009 led to a disproportionately large therapeutic effect through advances in cancerous and infectious diseases (Stevens *et al.* 2011). The NIH example here has particular relevance to the public option idea in pharmaceutical innovation, which will be discussed in Section 6. These 'mission-oriented'

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<sup>1</sup> Authors' calculation based on the following data sources: <https://www.nih.gov/about-nih/what-we-do/budget>; <https://www.nih.gov/about-nih/what-we-do/nih-almanac/appropriations-section-1>; <https://www.nih.gov/about-nih/what-we-do/nih-almanac/appropriations-section-2>. Inflation rates used: <https://www.officialdata.org/us/inflation/2020>.



institutions (Mazzucato 2017, 2018b; Mowery 2010; Foray, Mowery and Nelson 2012) actively created new industrial and technological landscapes.

This pattern is being repeated in renewable energy, where the US government has been behind some of the most important advances through innovation in agencies such as the Advanced Research Projects Agency–Energy (ARPA-E), the sister organisation of DARPA in the Department of Energy, as well as the recent revolution in fracking to extract shale gas (Trembath *et al.* 2012). Today, the Chinese government is also the largest global funder of green innovations (Mazzucato and Semieniuk 2016). In all these cases — from ICT to health and energy — it has been these early direct public investments that have prepared the ground, creating and shaping new landscapes that businesses develop only later.

Such market-shaping has also occurred through *demand pull* instruments, from government procurement policy (e.g. by purchasing a high volume of semiconductors in the early stages, the state contributes to a fall in costs), as well as bold policies to shape consumer demand, such as suburbanisation, which allows the impact of the mass production revolution to become fully deployed and diffused across the economy.

Should the public sector do everything? Of course not. The point is not that the private sector is unimportant, but that in new sectors like biotechnology, nanotechnology and the emerging green economy, private businesses have tended to invest only *after* returns were in clear sight. The animal spirits of business investors are themselves an endogenous function of public investment, roused only after public investments have laid the groundwork in the highest-risk and most capital-intensive areas. This role of public investment is recognised in terms of the ‘basics’, such as infrastructure (without roads, businesses would have no way of transporting goods) and protecting private property, but beyond that it is largely ignored.

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## 4. Government failures

Of course the story is not always a positive one. While the examples above focus on public investments that have led to important successes (e.g. the Internet, GPS, shale gas, blockbuster drugs), there are also government investments that end in failure. These include investment in products like the Concorde aircraft, which ultimately failed commercially; in the discovery of new drugs (of which most attempts fail); or the provision of guaranteed loans to companies which then go bankrupt. A recent example of the latter includes the guaranteed loan of \$528 million provided by the US Department of Energy to the company Solyndra for the production of solar cells. This was followed by the company's bankruptcy, when the price of silicon chips fell dramatically, leaving the taxpayer to pick up the bill (Wood 2012). Any venture capitalist will argue that attempts to innovate require exploring new and difficult paths, and that occasional failure is part of that journey. Indeed, a similar guaranteed loan (\$465 million) was provided to Tesla for the development of the Model S electric car — which led to success.

This *trial-and-error* process, in which tolerance of failure is also the road to success, is accepted in the private sector, but when governments fail this is regarded as a sign of incompetence, often leading to accusations that the government is unable to ‘pick winners’. As a result, public

organisations are frequently told to stick to 'levelling the playing field' and to promote competition without 'distorting' the market by choosing specific technologies, sectors or companies to invest in (Owen 2012). Yet this ignores our first point, that markets are outcomes, and they have historically been outcomes of government playing a lead role: none of the great advances of the 20th century would have occurred without public investment.

There are, nevertheless, good reasons to worry about government failures outside this natural trial-and-error explorative process. These reasons arise from situations where 'rent-seeking' behaviour in the business community leads to government being captured by vested interests (Tullock, Seldon and Brady 2002). Rents arise when value is extracted through special privileges (Kruegher 1974) and when a company or individual grabs a large share of wealth that would have been produced without their input (Stiglitz 2012, p. 32). The idea is that profit-maximising firms are likely to try to increase their profits through special policy-related favours and this often leads to success on their part, because politicians and policymakers are seen as naturally prone to corruption. Rent-seeking could arise from specific companies, or sectors, seeking extra funding from government through either a subsidy or a tax credit of some sort. Such concerns are valid, but these problems become more acute precisely when there is not a clear view of government value. If the state is seen as irrelevant, it will over time also become less confident and more easily corruptible by different actors who call themselves the 'wealth creators'. It is these actors who can then convince policymakers to hand out favours in order to increase wealth.

Furthermore, some rent-seeking may occur precisely as a result of problematic assumptions regarding the role of public investment. If private investment is driven by perceptions of future opportunities in a sector, and if those opportunities are highly correlated with direct public investments that create markets into which business investment later moves, then policy tools which are overly focused on indirect support to business (e.g. via tax incentives) will create far less additionality. That is, they will not make things happen that *would not have happened anyway*. They may increase profits (through a reduction of costs), but not investment. And the primary objective of the policymaker should be to increase business investment, not profits. In this sense, such policies can lead to rent-seeking outcomes, even if there were no explicit 'rent-seekers': they result in a company or individual earning income without having generated any wealth.

An example is the way in which the private equity and venture capital community successfully persuaded governments in the US and Europe of their wealth-creating potential, and of the need to reduce capital gains to make this happen. In the US, capital gains tax fell by 50 percent in five years at the end of the 1970s as a result of pressure from the National Venture Capital Association (Lazonick and Mazzucato 2012). As the US investor Warren Buffett put it, such policies do little for investment, which is driven by expectations of growth opportunities or what Buffet calls 'sensible' investments, while increasing job destruction and inequality (Buffett 2011).

Once we admit that the state has been a market-shaper and creator, a lead investor and a risk-taker, the next question is how to make sure that policy leads not only to the socialisation of risks, but also of rewards. A better realignment between risks and rewards, across public and private actors, can become a concrete way to allow smart, innovation-led growth to also become inclusive growth. We turn to this in Section 5.

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## 5. Socialising risks and rewards

In ignoring the entrepreneurial role of the state as lead investor and risk-taker, and focusing only on the role of the public sector as setting the background (horizontal) conditions, orthodox economic theory has also ignored the way in which the socialisation of risks should be accompanied by the socialisation of rewards. Indeed, the more downstream the public investments in particular technologies and firms, the higher the risk that one of those technologies or firms will fail. But this is indeed normal, as any venture capitalist would admit: for every success there are many failures. In reality, the most successful capitalist economies have had active states that made risky investments, some of them contributing to technological revolutions. The Finnish public innovation agency, SITRA, has had some great successes, but also some failures. Likewise, Israel's public venture capital fund, Yozma. In the Anglo-Saxon economies public debate has been too quick to criticise public investments when they go wrong and too slow to acknowledge the state's role in those that succeed.

However, this raises a more fundamental question: how to make sure that, like private venture capital funds, the state can reap some return from the successes (the 'upside'), in order to cover the inevitable losses (the 'downside') and finance the next round of investments. This is especially important given the path-dependent and cumulative nature of innovation. Returns arise slowly; they are negative in the beginning and gradually build up, potentially generating huge rewards after decades of investment. Indeed companies in areas like ICT, biotechnology and nanotechnology had to accept many years of zero profits before any returns were in sight. If the collective process of innovation is not properly recognised, the result will be a narrow group of private corporations and investors reaping the full returns of projects that the state helped to initiate and finance.

So who gets the reward for innovation? Some economists argue that returns accrue to the public sector through the knowledge spillovers that are created (new knowledge that can benefit various areas of the economy) and via the taxation system due to new jobs being generated, as well as taxes being paid by companies benefiting from the investments. But the evolution of the patenting system has made it easier to take out patents on upstream research, meaning that knowledge dissemination can effectively be blocked and spillovers cannot be assumed. The cumulative nature of innovation and the dynamic returns to scale (Nelson and Winter 1982) mean that countries stand to gain significantly from being first in the development of new technologies. At the same time the global movement of capital means that the particular country or region funding initial investments in innovation is by no means guaranteed to reap all the wider economic benefits, such as those relating to employment or taxation. Indeed, corporate taxation has been falling globally, and corporate tax avoidance and evasion have been rising. Some of the technology companies which have benefited most from public support, such as Apple and Google, have also been among those accused of using their international operations to avoid paying tax (Johnston 2014). Perhaps most importantly, while the spillovers that occur from upstream 'basic' investments, such as education and research, should not be thought of as needing to earn a *direct* return for the state, downstream investments targeted at specific companies and technologies are qualitatively different. Precisely because some investments in firms and technologies will fail, the

state should treat these investments as a portfolio and enable some of the upside success to cover the downside risk.

In particular, there is a strong case for arguing that, where technological breakthroughs have occurred as a result of targeted state interventions benefiting specific companies, the state should reap some of the financial rewards over time by retaining ownership of a small proportion of the intellectual property it had a hand in creating. This is not to say that the state should ever have exclusive licence or hold a large enough proportion of the value of an innovation to deter its diffusion (and this is almost never the case). The role of government is not to run commercial enterprises; it is to spark innovation elsewhere. But by owning some of the value it has created, which over time has the potential for significant growth, funds can be generated for reinvestment into new potential innovations. By adopting a 'portfolio' approach to public investments in innovation, success from a few projects can then help cover the losses from other projects. In this way, *both* risks and rewards are socialised (Mazzucato 2016).

## 5.1 Examples of direct forms of public rewards

There are many examples of public organisations that have strategically considered the distribution of risks and rewards. At times, they have granted licenses to private firms willing to invest in upgrading publicly owned technologies, offering the opportunity for public and private to share risks and also rewards. For example, NASA has sometimes captured the returns from its inventions, while private partners gained on the value-added in the case of successful commercialisation (Kempf, 1995). Further there are examples of state-owned venture capital activity generating royalties from public investments (e.g. in Israel — see Avnimelech 2009) or equity (e.g. in Finland via SITRA), and the more pervasive use of equity by state development banks (e.g. in Brazil, China and Germany — see Mazzucato and Penna 2016).

Policy instruments for tackling risk-reward issues combine supply- and demand-side mechanisms, and are geared to enabling public value creation through symbiotic public-private partnerships ('active') (Lazonick and Mazzucato 2013) and blocking value extraction ('defensive').

The different mechanisms for distributing rewards can work either directly through profit-sharing (via equity, royalties) or indirectly through conditions attached, focussed more on the market-shaping role. The latter may involve conditions on the reinvestment of profits, conditions on pricing or conditions on the way that knowledge is governed. We review these below.

**a) Pricing capping schemes.** On the defensive side, to ensure taxpayers do not pay twice, governments might want to adopt pricing capping regulations instead of relying on market forces to spontaneously produce equitable prices. Indeed, such a possibility exists under section 203 of the Bayh-Dole Act, which established the US government's 'march-in' right over pharmaceuticals if, among other reasons, patent holders that benefited from public funding fail to satisfy the 'health and safety needs' of consumers (Sampat and Lichtenberg 2011). Despite numerous discussions over time (Davis and Arno 2001; Korn and Heinig 2004), it has not thus far been implemented. Another instrument for ensuring competitive prices is the implementation of competition and antitrust policies, which may be far less tolerant of monopoly prices than has been the case over, say, the past 40 years in the US (Stiglitz 2017).

**b) Conditions on reinvestments.** Another possibility is to negotiate conditions on reinvestment into the real economy, which can be achieved through regulation and/or attached to financing contracts. In fact, the inception of Bell Labs resulted from the Department of Justice's implementation of antitrust laws (Brumfiel 2008): in 1925, among the conditions imposed on AT&T in order for it to be able to retain its monopoly over the phone system, the US government required the company to reinvest a share of its profits in research. Conditions targeting the creation of specific commercial, industrial or technological benefits in the context of defence-related procurement ('offset agreements') are also common practice in many countries. Most remarkably in Sweden, where this instrument has been explicitly part of a strategy to promote the military aircraft industry (Eliasson 2017), but also in the US and Brazil (Vieira and Alvares 2017), among others.

**c) Knowledge governance.** Several measures can be articulated to advance the creation and diffusion of the key knowledge needed to tackle problems like climate change, poverty, etc. One is to reform the IPR system so as to harmonise it with the broader set of institutional requirements for multiple actors to access and use knowledge (Henry and Stiglitz 2010). This involves ensuring IPR is flexible enough and patents are good quality, used for productive instead of financialisation purposes, and narrow in scope and length (Mazzoleni and Nelson 1998; Frischmann and Lemley 2007). IPR may also be managed strategically through the exploitation of some of the flexibilities still left under the WTO-TRIPS agreement. For example, governments may choose — or threaten — to issue compulsory licenses in order to obtain access to knowledge and/or price reductions on proprietary goods. In the 2000s, this was used to promote access to medicines (e.g. in Brazil, India, Indonesia, South Africa, etc.) and genetic diagnostic tests (in France), and the purchase of antibiotics for defence purposes<sup>2</sup> (in the US) (Reichman 2009). Where IPR blocks the creation and diffusion of knowledge that is key for competitors (e.g. through refusals to license or defensive patenting behaviour), competition and antitrust policies may help, as applied by European authorities (Motta 2004). These may be more effective if supplemented by alternative incentives such as 'open source' and prizes. In particular, featuring as lead investor offers more opportunities for public organisations to choose whether to hold title over resulting inventions and negotiate licensing conditions, while engendering within-industry and across-the-economy spillovers, as defence-related R&D spending in the US illustrates (Mowery 2009).

**d) Tax reforms.** On the one hand, tackling present evasion, avoidance, loopholes and tax incentives for unproductive entrepreneurship — like the patent box which increases profits without increasing business investments, or reduced tax rates over capital as compared to corporate gains — may enhance the government's revenues and its redistributive capacity (Lazonick and Mazzucato 2013). On the other hand, tax regulation can be designed to more actively incentivise productive entrepreneurship using measures such as low taxation for hiring labour and high for financial transactions. In addition, in seeking to capture a direct share of the profits resulting from strategic investments, the state may choose to create some form of tax-based mechanism (Enke 1967). Realistically, however, distributive tensions require governments to be creative and,

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<sup>2</sup> See D. McNeil Jr, A nation challenged: the drug, a rush for Cipro and the global ripples, New York Times, 17 October 2001. Available at: <http://www.nytimes.com/2001/10/17/world/a-nation-challenged-the-drug-a-rush-for-cipro-and-the-global-ripples.html>.

wherever possible, seek tax reforms which may more commensurately reflect its role in the economy — not just ‘fixing’ but also ‘creating’ markets.

**e) Revenues beyond taxation.** On the strategic front, to ensure that both risks and rewards are shared with supported firms, the government might claim a share of the financial gains resulting from public investments, which it can use to cover the inevitable losses and make future investments. Compared with other measures discussed above, direct profit-sharing can better generate directionality of innovation and enhance the flexibility of the management of the recouped revenues. The choice of a profit-sharing mechanism and its intended form of public return should be considered according to the financing instruments selected to support innovation (Laplane and Mazzucato 2020). A number of examples are summarised below in Table 1.

This list is not meant to be exhaustive, but rather illustrates that there are multiple experiences in handling policy instruments that, implicit or explicitly, permit taking account of issues like value extraction and enabling government to capture a share of the value it helped to generate. The latter, in particular, has been adopted by different types of agencies, at different stages of the innovation chain, but mainly downstream, involving different types of partners (e.g. firm size) and industries. However, these have not always been adjusted to the specificities of different economic, industrial and legal settings. Without a framework that more clearly informs these policies, decisions on these matters have sometimes been made unintentionally and haphazardly, inviting both government and systemic failures.

Table 1. Existing policy instruments for financing innovation that allow for profit-sharing (selected examples)

<b>Financing instruments</b>	<b>Types</b>	<b>Key features</b>	<b>Returns to funding agency</b>	<b>Some country examples</b>
<b>Debt financing</b>	<b>Repayable grants/ advances</b>	Repayment required, partial or total; could be granted on the basis of private co-funding	Royalties of IPR licensing or levy on sales (Windus and Schiffel 1976)	Repayment grants for start-ups from 2014 to 2016 (New Zealand), Dutch Technological Development Loan programme carried out by the Senter-agency of the Ministry of Economic Affairs from 1954 to 2001 (Kaivanto and Stoneman 2007)
<b>Debt/equity financing</b>	<b>Mezzanine funding</b>	Combination of several financing instruments that incorporate elements of debt and equity in a single investment vehicle	Interest rates plus spread	Credit line mezzanine financing (Portugal)
<b>Equity financing</b>	<b>Venture capital funds and fund of funds</b>	Funds provided by institutional investors (e.g. banks, pension funds) to be invested in firms at early-to-expansion stages  Referred to as 'patient capital', due to lengthy time span for exiting (10 to 12 years)	Equity stakes	Innpulsa (Colombia), National Innovation Fund — Venture Capital Fund (Czech Republic), Corporate Venture Programme (France), Yozma Fund (Israel) (Erlich 2002; Avnimelech 2009; Lerner 2010), Scottish Co-Investment Fund (UK)
<b>Public procurement for R&amp;D and innovation</b>		Demand for technologies or services that do not exist yet; or purchase of R&D services (pre-commercial procurement of R&D)	IPR of research results; agency can opt to shift ownership to contractors and establish licensing conditions	Entrepreneur Growth Strategy (Estonia), Strategy for Public Procurement (Sweden), Small Business Innovation Research (SBIR) Program (US) and SBIR-type of programmes (UK)

Source: Adaptation of OECD (2014, 2016) by Laplane and Mazzucato (2020)

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## 6. Public option as a market-shaping policy for delivering public rewards

This The previous sections have described the theories behind the problematic but prevailing framing of government as a fixer of market failures, versus an alternative one that highlights the less familiar story of government as a market shaper. The latter underlines the role of government as an investor of first resort and a risk-taker in innovation. This socialisation of risk-taking leads to a better way of interpreting government failures as the cost of exploration and learning, and the implication that the rewards from the resultant public-backed innovations should also be socialised. A number of policy instruments, as described above, can achieve this purpose.

This section will now introduce the public option as an innovation and manufacturing policy (using the pharmaceutical sector as a main example) and situate it within the broader theoretical discussion about the entrepreneurial state described above. In building a conceptual case for a public option pertinent to innovation and manufacturing, we argue that the public option is yet another power tool for delivering public rewards.

### 6.1 Policy context for a public option in innovation and manufacturing

Building on Sitaraman and Alstott's (2019) conceptualisation of the public option — which the authors apply to the examples of health care, retirement, higher education, banking, childcare and other social and public services — policy makers, advocates and scholars have since extended the application of the idea to the field of innovation and manufacturing, with the pharmaceutical sector being one of the most prominent examples due to its strong relevance and proximity to health policy and drug pricing policy debates.

In the US, in late 2018, motivated by problems surrounding high drug prices and shortages of critical medicines, most prominently insulin, Senator Elizabeth Warren (D-Mass.) and Congresswoman Jan Schakowsky (D-Ill.) introduced the Affordable Drug Manufacturing Act. It was a public option in all but name: it would task the Department of Health and Human Services 'with the public manufacturing of generic drugs in cases where the market has failed and strengthens the generic market for the long term by jump-starting competition' (Warren 2018). Although the legislation did not progress beyond its introduction at the US Senate, the thinking behind the bill coincided with a broader, ongoing discussion about the crucial role of the state in pharmaceutical innovation in the US and internationally, and inspired fresh thinking by lawmakers on the extent to which the state can play a more proactive part in the sector. In the UK, for example, the opposition Labour Party included the idea of a public-sector pharmaceutical company in its pharmaceutical policy, *Medicines for the Many: Public Health before Private Profit*, prior to the 2019 General Election. Discussions about expanding the roles of key public-sector institutions critical to biopharmaceutical innovation have along been circulating, amplified by the central role of publicly funded innovations in addressing emerging public health crises such as the Ebola outbreak (Herder, Graham and Gold 2020) and antibiotic resistance (Singer, Kirchhelle and Roberts 2019). Added to this, increasing interest in the importance of state-level manufacturing has been accentuated by real-world developments, most prominently the establishment of Civica Rx, a non-profit generic drug manufacturer that aims to ensure the affordable supply of essential



medicines for over 120 health organisations in the US. The public option concept provides a locus for the two strands of ideas and has set the scene for nascent policy and research efforts that examine pharmaceutical innovation and manufacturing in the context of industrial policy, and draw on empirical examples from around the world (Brown 2019).

## 6.2 The case for a pharmaceutical public option: from market fixing to market shaping

The previous sections have described the theories behind the problematic but prevailing framing of government as a fixer of market failures, versus an alternative one that highlights the less familiar story of government as a market shaper. The latter underlines the role of government as an investor of first resort and a risk-taker in innovation. This socialisation of risk-taking leads to a better way of interpreting government failures as the cost of exploration and learning, and the implication that the rewards from the resultant public-backed innovations should also be socialised. A number of policy instruments, as described above, can achieve this purpose.

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central role of publicly funded innovations in addressing emerging public health crises such as the Ebola outbreak (Herder, Graham and Gold 2020) and antibiotic resistance (Singer, Kirchhelle and Roberts 2019). Added to this, increasing interest in the importance of state-level manufacturing has been accentuated by real-world developments, most prominently the establishment of Civica Rx, a non-profit generic drug manufacturer that aims to ensure the affordable supply of essential medicines for over 120 health organisations in the US. The public option concept provides a locus for the two strands of ideas and has set the scene for nascent policy and research efforts that examine pharmaceutical innovation and manufacturing in the context of industrial policy, and draw on empirical examples from around the world (Brown 2019).

## 6.4 The case for a pharmaceutical public option: from market fixing to market shaping

The case for a pharmaceutical public option is motivated both by theory and by practical concerns about the existing pharmaceutical sector, in which value creation by different actors are problematically attributed, as are the rewards of innovation. Through the lens of the entrepreneurial state introduced in the foregoing sections, the public option is about much more than simply fixing market failure, it is also about better enabling the state to develop transformative innovations — which it already does — and strengthening its capability to create value in the innovation system.

The public sector is a cornerstone of the pharmaceutical industry, often taking on the highest risk in the early stage of innovation. As described in Section 2, NIH is fundamental to biomedical science and early drug discovery, from early through to late stage development (Nayak, Avorn and Kesselheim 2019). At the time of writing, the world is wrestling with the COVID-19 pandemic and in search of a coronavirus vaccine, and public investment once again forms the backbone of this crucial project. Since the 2002 SARS outbreak, NIH has spent \$700 million on coronavirus R&D (Rizvi 2020). In addition, it is also key to creating clusters that connect different actors in the innovation and manufacturing ecosystem with health system demand, thus shaping the pharmaceutical market across its entire value chain.

While the private sector is also crucial in bringing cutting edge medicines to the market, its entrenched short-termism and misalignment with public interest are equally striking (UCL Institute for Innovation and Public Purpose 2018). First, companies prioritise 'blockbusters' at the expense of commercially unappealing medicines that are hugely important to public health (Moon, Bermudez and 't Hoen 2012). Second, the pricing of these medicines does not take into account the contribution made by other actors, including public institutions (Mazzucato and Roy 2018; Mazzucato 2018a). Third, patents are often abused, being too upstream, wide and strong (Mazzoleni and Nelson 1998), and high prices can persist even as generic competition kicks in, as a result of occasional cases of inefficient competition (Luo, Kesselheim, Greene and Lipska 2017). Fourth, high prices are driven by, and in turn fuel, the over-financialisation of parts of the industry, where share buybacks are outpacing R&D (Tulum and Lazonick 2018) These prices also lead to a drive to cut costs by outsourcing manufacturing capabilities overseas at the expense of local capacity (Pisano and Shih 2012).

Moreover, public investment has created significant private return with no effective guarantees for public return. In addition to generating knowledge spillovers, public investments have generated significant positive economic effects for the private sector. Public investment in biopharmaceutical science creates positive fiscal impact for the private sector by generating further investments ('crowding in') and substantial drug sales revenue. On the one hand, every £1 of public research expenditure is associated with an additional £0.87 to £1.07 of private sector R&D spend in the UK (Sussex *et al.* 2016). On the other hand, it is estimated that \$10 million investment by the NIH leads to between \$13.0 and \$27.8 million in drug sales (Azoulay *et al.* 2018).

Therefore, given its fundamental role, the state should govern the drug innovation process more like a market-shaper: steering innovation, getting fair prices, ensuring that patents and competition work as intended, setting conditions for reinvestment, and safeguarding medicine supply. In other words, this is about finding a way to govern a system that is not working for members of the public, who have invested in some of the riskiest stages of drug development.

Policy instruments to capture public return described in the last section — including the examples of price capping, conditions on reinvestments, knowledge governance, tax reforms and revenues beyond taxation — are all crucial to addressing the failings of the current system, but none of the above can ensure public return in the form of direct provision. In this light, the pharmaceutical public option — government-provided, quality-assured medicines that are universally available at a reasonable and fixed price, which coexist with products from the private sector — can be a fresh approach to delivering public returns. Compared to these other forms of instruments, the pharmaceutical public option provides a more proactive means for the state to shape an industrial policy landscape that serves broader public interest in addition to the rights to health and access to medicines (UCL Commission for Mission-Oriented Innovation and Industrial Strategy 2019). First, having national manufacturing capabilities would be essential for protecting national security. The outsourcing of manufacturing capabilities has created vulnerability in the supply chain, which can lead to crippling shortages in quality-assured, essential medicines, especially at the times of need (US Department of Health and Human Services, Food and Drug Administration, Center for Drug Evaluation and Research, Center for Biologics Evaluation and Research 2020). Second, improving public-sector innovation and manufacturing capabilities can lead to greater national competitiveness. Building a strong, public-sector-led industrial commons would be critical in harbouring the process innovation essential to highly complex biopharmaceuticals such as biological, cell and gene therapies (Pisano and Shih 2012). Third, as argued by Sitaraman and Alstott (2019), having a yardstick pharmaceutical public option can help to establish more efficient market competition, which can be complicated or prevented by huge barriers to entry and over market concentration. This can be addressed as the public option is introduced, along with transparent information on its R&D and manufacturing.

A pharmaceutical public option would require the government to be more directly involved in coordinating and executing the full range of activities in drug innovation and manufacturing. While more research is required in order to articulate the models of pharmaceutical public options and how they are best delivered in different country contexts, it is evident that the policy instrument would require government to be more directly involved in coordinating and executing the full range of activities in drug innovation and manufacturing, whatever the forms of implementation.

A degree of public ownership is necessary to allow government to retain a sufficient level of control to carry out those activities. Public ownership would equip the state with greater strategic control over long-term capital allocation and give it the resources to strengthen dynamic capability in the public sector (e.g. national laboratories and strategic agencies such as the Biomedical Advanced Research and Development Authority). Rather than micromanaging companies, public ownership needs to focus on delivering a public benefit for public investment, both in terms of achieving a public health-oriented direction of R&D, and ensuring the pricing of the resultant pharmaceuticals better reflects the public contribution and they are affordable. This is the very reason why the ex-chief economist of Goldman Sachs and former Chair of the Review on Antimicrobial Resistance, Lord Jim O'Neill, recently called for nationalisation to help solve the crisis in antibiotics innovation (Smyth 2019). Although wholesale nationalisation of the pharmaceutical industry is unlikely to be a realistic nor productive approach, part-nationalisation of certain pipelines that lie dormant in the private industry and are proving unresponsive to conventional market-fixing measures — antibiotics, for example — could turn out to be the only way to revive them. The next section will therefore discuss the role of public ownership in public option.

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## **7. The role of public ownership**

The above examples of direct forms of public returns — from the state owning private equity to the public option — all imply some degree of public ownership. For many parts of the capitalist world, this may appear to be a significant anathema. However, the key purpose of those measures is not about the public sector taking over from private sector — this is never part of the equation — but about building symbiotic, rather than parasitic, public-private relationships that deliver the best deals for all.

The prospect of the state owning a stake in a private corporation is not an unusual idea given that governments are already investing in the private sector. Because of that, they may as well earn a return on those investments (something even fiscal conservatives might find attractive). The state need not hold a controlling stake, but it could hold equity in the form of preferred stocks that are given priority for receiving dividends. The returns could be used to fund future innovation (Rodrik 2015). Politicians and the media have been too quick to criticise public investments when things go wrong, and too slow to reward them when things go right.

Public ownership, as an integral part of public option, is also sometimes associated with the concepts of nationalisation and state-owned enterprises. In general, state-owned enterprises have been associated with various forms of wasteful inefficiencies. The accusations seem to have found confirmation in poor financial results. However, profits and losses, important as they are for the ability of a company to preserve its autonomy, are often misleading indicators of efficiency. As argued in Section 4, behind government 'failures' are vast learning experiences. In addition, they can be the source of new organisational and technological capabilities, while fostering structural change in the economy at large. Several acclaimed cases of successful industrial development (e.g. Italy, South Korea, China, the Scandinavian countries, etc.) demonstrate that state-owned enterprises can become effective mechanisms for transformational policies when their activities

are oriented towards industrial objectives and coordinated according to a systemic logic. In the South African economy, large state-owned companies, in the automotive sector in particular, have presided over fundamental technical capabilities accumulated through decades.

Thus, the design of a 'smart' industrial strategy, which combines a long-term general orientation towards societal missions with ordinary industrial commercial undertakings, will be of utmost importance. Also, rather than worrying so much about the 'picking winners' problem, more thinking is needed about how to realise the inherent opportunities in the systemic role of a state ownership portfolio to deliver overall returns: namely, how to reward the winning investments so they can both cover some of the eventual losses (which are inevitable in the innovation game), and also raise funds for future investments. This can be done by, first, getting the tax system to work, and, second, considering other mechanisms that allow the state to reap a direct reward in those cases when it is making specific bets on companies. If all fails, the taxpayer picks up the bill, but when it goes well, the taxpayer gets rewarded.

Going hand in hand with this consideration is the need to rethink how public investments are accounted for in the national income accounting. Investments in innovation are different to current expenditures. The latter does not add to balance-sheet assets; the former does and is potentially productive investment in the sense that it creates new value (Mazzucato and Shipman 2014). When setting limits to fiscal deficits, it is therefore necessary to distinguish public debt contracted for investment in R&D and infrastructure (value-creating investments) from public debt contracted for (public or private) consumption. In this sense, financial and accounting reforms should be regarded as a prerequisite for any successful smart and inclusive growth plan.

Finally, considering the role of government as lead risk-taker helps to debunk fundamental assumptions behind the *theory of shareholder value*, which has underpinned the exorbitant rewards earned by senior executives in recent years. Pay via stock options has been a key feature of modern capitalism, and a key driver of the inequality between the top one percent of income earners and the rest (Piketty 2014). Stock options are boosted when stock prices rise and prices often rise through 'financialised' practices such as share repurchase schemes by companies (Lazonick 2014). Focusing on boosting share prices is justified on the grounds of the theory of *shareholder value*, which holds that shareholders are the biggest risk-takers in a company, because they have no *guaranteed* rate of return (while workers earn set salaries, banks earn set interest rates, etc.). That is, they are the *residual claimants* (Jensen 1986), but this assumes that other agents do have a guaranteed rate of return. The financialisation problem is part of what drives pharmaceutical companies away from R&D, as described in Section 6.

As we have argued throughout this paper, precisely because what the state does is not just facilitate and de-risk the private sector, but also take major risks, there is no guarantee of success for its investments, which have historically also played a crucial role in enabling wealth creation. In the context of public option, public ownership is not only a direct and potentially effective tool for driving and orienting industrial and economic development, but also a crucial tool for safeguarding long-term value. Without a patient long-term owner, companies could exist under a highly unsustainable governance that would favour the short-term interests of new shareholders over its various stakeholders and the economy at large. The fact that a key driver of inequality has been linked with a problematic understanding of which actors are the greatest risk-takers implies that

combatting short-termism (Haldane 2016) and speculative forms of corporate governance (Kay 2012) requires not only reforming finance and corporate governance, but also rethinking the models of wealth creation upon which they are based (Lazonick and Mazzucato 2012).

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## **8. Conclusion**

The state as not only a market-fixer, but also — and especially — a market-maker and shaper, contributes to economic growth through the co-creation of value and hence a just division of rewards between public and private actors can be produced. Given the state's role as risk-taker and investor of first resort, new thinking is required for public institutions to not only share in the risks, but also the rewards. This can encourage new approaches to achieving growth that is not only 'smart' (innovation-led), but also more inclusive. In this context, public options, among other policy approaches that include elements of public ownership, provide a new venue for policy thinking to marry economic growth with societal missions.

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