

Working Paper

The role of patient finance in mission-oriented innovation: the market shaping role of state investment banks

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The role of patient finance in mission-oriented innovation: the market shaping role of state investment banks

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Abstract

To achieve innovation and investment-led growth, the EU requires patient, long-term committed finance. This report, which incorporates two previously published papers supported by the ISIGrowth project, examines the role of state investment banks (SIBs) in providing patient finance. We first review how the mainstream “market failure theory” justifies the existence of SIBs. We then propose an alternative conceptualisation drawing upon insights from heterodox economic theory that argues SIBs can help deliver mission-oriented innovation policies via their market shaping and market creating role. We then present an analysis of eight different SIBs, including six in Europe, examining their mission and vision, economic role, investment activities, management of risk and reward and their links to government policy. The paper concludes by drawing out lessons for the way in which the EU could increase patient finance by expanding the role of the European Investment Bank and member state investment banks.

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Glossary

ARPA-E – Advanced Research Project Agency-Energy

BNDES – *Banco Nacional de Desenvolvimento Econômico e Social*

CDB – China Development Bank

CDP – *Cassa Depositi e Prestiti*.

DARPA – Defense Activated Research Projects Agency

EIB – European Investment Bank

GDP – Gross domestic product

GIB – Green Investment Bank

GVA – Gross value added

KfW – *Kreditanstalt für Wiederaufbau*

NIB – Nordic Investment Bank

IMF – International Monetary Fund

1. Introduction

Despite the evidence of economic growth returning to Europe over the last year, there remain major challenges for EU countries in regard to investment and innovation.

According to the European Investment Bank's latest Investment report (EIB 2017), although business investment is recovering, government investment remains at a 20-year low of 2.7 per cent of EU gross domestic product, a consequence of fiscal austerity policies that hit capital expenditure particularly hard. The EU has also seen increasing polarisation between regions and member states in regard to investment. Southern European members – Greece, Spain and Italy in particular, but also Finland – have seen large falls in investment relative to the EU average and the United States (Dosi et al 2017). These countries are also suffering from elevated levels of unemployment, anaemic growth and rising poverty.

EU investment in research and development (R&D) remains – at 2% - well below growth in the US, China, Japan and South Korea, where business R&D expenditures are considerably higher (EIB 2017, p7). The EU has a more fragmented and less centralised innovation system than these competitors making it harder to gain scale advantages in selected sectors (Mazzucato 2018, p5). EU Investment in climate change mitigation has declined from 1.6% of GDP in 2012 to 1.2%, raising concerns that the EU will fail to meet its ambitious 2030 carbon reduction target (EIB 2017, p10). Both EU municipalities and firms report major under-provision in ICT and urban transport infrastructure as major barriers to economic development and social welfare (ibid, p11).

Financing remains a constraint for smaller, younger and innovative firms or those with high investment in intangibles who typically lack a credit history or whose assets are impossible to collateralise (Ibid, p18). This lack of investment in intangibles is particularly worrying given that across the EU as a whole, manufacturing production is now almost 10% lower than at the start of the crisis (Lucchese et al, 2016). According to a recent estimate, a continuation of the present trend in de-industrialisation would imply a 12% share of industry in GDP in 2020, remarkably small for a rich economic zone (Griffiths-Jones and Cozzi, 2016, p121).

How then can the EU boost innovation-led investment to meet these structural challenges? This report reviews the role of state investment banks (SIBs), or development banks¹, as a source of patient, long-term finance and as agents of economic development. It brings together two previous publications carried out during the ISIGrowth project:

1. Mazzucato, Mariana, and Caetano CR Penna. "Beyond market failures: The market creating and shaping roles of state investment banks." *Journal of Economic Policy*

¹ The terms 'development bank(s)' and 'state investment bank(s)' are often used interchangeably. However, we prefer the later expression, to differentiate from 'development finance institutions', which are active in developing countries (e.g. providing aid). SIBs are active both in the developing and developed world.

Reform 19.4 (2016): 305-326. (sections 2-4 of the report below are reproduced from pages 308-320 of this article).

2. Mazzucato, Mariana, and Laurie Macfarlane (2018) "State investment banks and patient finance: an international comparison", Policy Report, IIPP WP18-01. (Section 5 of the report is reproduced from pages 10-17, 26-30, 72-81 of this report).

SIBs have played a key role in the economic development of many countries and continue to do so today around the world. They played a key role in supporting investment in the European economy following the financial crisis of 2007-08. Between 2007 and 2014 the European Investment Bank (EIB) increased its assets by almost 100%, the Italian Cassa di Risparmio di Roma by 80% and the German KfW by 40% respectively and the Finnish Finnvera by 275 % (Mertens and Thiemann 2017). A number of new SIBs have also been founded – including in Ireland, Portugal and the UK. Indeed today every EU country has one SIB or is the process of founding one (Scotland publically announced it would be launching an SIB in February 2018).

SIBs played an important European wide role in The Investment Plan for Europe and its European Fund for Strategic Investment (EFSI) launched in 2014 by Claude Juncker. The EFSI steering board was located inside the EIB which was equipped to leverage funds from the EU budget to mobilize private investment. Meanwhile national SIBs became both contributors to the fund and stakeholders (European Commission 2014 ; European Commission 2015b).

In recent years, some SIBs have taken on a new role as key domestic and global actors driving economic growth and innovation, particularly through addressing contemporary challenges such as climate change. In 2012, for example, the share of development finance institutions in the "climate finance landscape" was 34% (the highest share of any single type of actor), compared to 29% for project developers (including state-owned utilities), 19% for corporate actors, 9% for households, 6% for all types of private financial institutions and 3% for executive governments (investments from governmental budgets) (Climate Policy Initiative 2013).

This level of investment directed towards an emerging new area recalls the role that state agencies played in the Internet revolution and the biotech revolution. In such cases, public investments did not only "fix failures in markets", they actively created them by investing across the entire innovation chain, from basic research to early stage commercialisation (Mazzucato 2013a), under the guidance of overarching technological *missions*. The literature on mission-oriented policy has under-conceptualized, however, the importance of the *type* of funding sources and financial instruments for mission-oriented policies. Instead, this strand of research has focused on demand-side innovation policies, such as the role that military procurement has played in technical change and radical innovation (Fuchs 2010; Fagerberg, Mowery, and Nelson 2005, Mowery 2012). While the role of public R&D agencies

in this process has been studied at length (Foray, Mowery, and Nelson 2012), the role of public banks in shaping such markets has not been studied.

It is important to study alternative sources of mission-oriented funding for innovation due to the differences between missions of the past and contemporary missions – the “grand societal challenges” that increasingly provide a rationale for economic growth and science, technology and innovation strategies, as in the case of the European Commission’s framework for research and innovation funding (EC 2011; Mazzucato 2018). The historical missions – best exemplified by the Apollo and Manhattan programmes – were clearly related to outcomes, such as putting a man on the moon or developing the atom bomb (respectively). Modern missions such as addressing the ageing/demographic problem or climate change are more complex as there is less of a clear technological objective signalling when the mission is accomplished (Soete and Arundel 1993; Foray, Mowery, and Nelson 2012). Contemporary missions aim to address broader and persistent challenges that require long-term commitments to the development of many technological solutions and “a continuing high rate of technical change and a set of institutional changes” (Freeman 1996, 34).

Given the actual and potential contribution of SIBs as sources of mission-oriented funding for innovation, the goal of this paper is to improve our understanding of the different roles that such public banks play, both historically (over time) and across the production landscape. While SIBs are not new, they have diversified their roles in the past three decades, going beyond traditional activities in both scale and scope.

The next section of the report provides a historical overview of the emergence of SIBs. Section 3 then reviews how the mainstream “market failure theory” (MFT) that emerged in the 1970s and 1980s justifies the existence of SIBs. In section 4 we propose an alternative conceptualisation drawing upon insights from heterodox economic theory that argues SIBs can help deliver mission-oriented (MO) innovation policies via their market shaping and market creating role.

We identify four different roles for SIBs: (1) countercyclical finance to offset the credit crunch during economic recessions; (2) funding for long-term projects, industrialisation and capital development of the economy (3) targeted investments in high-risk R&D, innovative start-ups and lengthy innovation processes, areas in which private capital has proved to be too short-termist and risk-averse to venture into; and (4) promotion of investments around complex societal problems such as climate change and the ageing crisis.

In section 5, drawing on academic literature and primary and secondary sources from other countries, we compare the activities of eight SIBs from different countries and regions, including the European Investment Bank, and analyse their role in their respective economies. Specially, we look at their mission and vision, economic role, investment activities, governance, sources of financing, funding instruments and their links to

government economic policy. We explore how different design features impact the role that each bank plays in its respective economy, and how this affects each bank's ability to successfully meet its mandate.

The paper concludes by drawing out lessons for the way in which the European Investment Bank and other European state investment banks could step up their mission-oriented innovation financing.

2. Historical overview of the emergence of modern SIBs

The first modern SIB – the International Bank for Reconstruction and Development (IBRD) – has its historical roots in the monetary agreements of Bretton Woods (1944), which were decisively influenced by Keynes's ideas, and the reconstruction plans for Europe following World War II (the Marshall Plan). The IBRD was meant to promote financial stability through a permanent flow of funding for the reconstruction plan and to unleash agricultural production potential, thereby preventing the deleterious effects that the speculative, pro-cyclical private financial sector could have on the post-WWII economic recovery (World Bank 2013). The IBRD made its first loan, to France, in 1947 (World Bank 2013).

Other national development banks were founded around that same time, such as the Industrial Development Bank of Canada (1944), the key goal of which was to provide "capital assistance to industry with particular consideration to the financing problems of small enterprises" (cited in Fergusson 1948, 214); or the *Kreditanstalt für Wiederaufbau* (KfW – meaning "reconstruction credit institute") in Germany (1948), which had the aim of channelling international (and national) funds (notably those associated with the Marshall Plan) to the promotion of long-term growth, infrastructure and modern industry (Schröder et al. 2011). Japan also created development banks. The first, in 1950, was the Export Bank of Japan (which became the Export-Import Bank of Japan in 1952), which sought to secure strategic resources to the Japanese economy and promote the insertion of Japanese firms into overseas markets. The second, in 1951, was the Japan Development Bank, the initial foci of which were development of heavy industries and infrastructure (including electricity). Another development bank, founded a couple of years later (1953), was the Brazilian *Banco Nacional de Desenvolvimento Economico e Social* (BNDES; National Bank of Social and Economic Development), which initially promoted a catching-up (industrialisation) agenda (Torres Filho and Costa 2012). The Korea Development Bank (KDB) was founded one year later as the "Korea Reconstruction Bank", to supply and manage major industrial capital and help develop Korean industries and economy after the Korean War.

In subsequent decades, SIBs diversified their operations. In the mid-1950s, for instance, KfW assumed the responsibility for providing finance for environmental protection and small-and-medium enterprises (SMEs), roles that were intensified in the 1970s, when it also began to target energy efficiency and innovation development (KfW 2009). In the 1960s, the Japan

Development Bank began to focus on financing technological development and innovation, as well as providing finance for projects that tackle environmental problems (such as atmospheric, water and noise pollution). In 1975, the Canadian Development Bank had its name changed to the Federal Business Development Bank (BDC; now the Business Development Bank of Canada) and started its venture capital operations. In the 1990s, the BDC created new financing products to promote the development of innovations. In 1976, South Korea founded a new development bank, the Export–Import Bank of Korea to support Korean enterprises in conducting overseas business⁸; meanwhile, KDB began to target the development of new sectors and technologies (electronics and automotive, in particular). In the 1980s, BNDES created lines of credit specifically designed for SMEs (while also helping a number of companies facing difficulties due to the Brazilian debt crisis), and in the following decade began to experiment with funding programmes targeted at high-tech firms and innovation (Branco 1994; Pinto 1997).

By the 2000s, the China Development Bank, founded in 1994, was one of the most active SIBs, investing in regional economic development and industrial catching-up; supporting and nurturing new ventures and innovation; and, later in the decade, targeting finance to projects aimed at “green growth” (Sanderson and Forsythe 2013). After the outbreak of the Global Financial Crisis in 2007, SIBs across the world significantly promoted countercyclical lending, increasing their loan portfolios by 36% on average between 2007 and 2009, with some (10%) increasing their loans by more than 100% (Luna-Martinez and Vicente 2012). They were actually returning to one of the original rationales behind the establishment of the IBRD: providing financial stability throughout the business cycle.

This brief historical overview highlights four conceptually distinct roles that SIBs have played throughout their histories and which they continue to play contemporarily:

- (a) Countercyclical role.
- (b) Capital development (or developmental) role.
- (c) New venture support (or “venture capitalist”) role.
- (d) Challenge-led role.

In the next section, we will examine these roles from the perspective of mainstream economic theory and policy focused on Market Failure Theory.

3. Justifying the four roles of SIBs: Market Failure Theory (MFT)

The mainstream economics perspective that explains and justifies the role of SIBs in the economy is MFT, which takes the “First Fundamental Theorem” (FFT) of welfare economics (Arrow 1951; Debreu 1959) as the starting point. The FFT states that markets are the most efficient allocators of resources under three specific conditions (Ledyard, 2008): (1) There is a complete set of markets, so that all supplied/demanded goods and services are traded at publicly known prices; (2) all consumers and producers behave competitively (all agents are price-takers); and (3) an equilibrium exists. Under these three conditions, the allocation of

resources by markets is “Pareto-optimal”; that is, no other allocation will make a consumer or producer better off without making someone else worse off. “Market failures” are said to occur when conditions (1) and/or (2) are violated; resource allocation by markets are in these situations inefficient. If markets are not Pareto-efficient, then everyone could be made better off through public policies.

Within this framework, market failure is only a necessary but not sufficient condition for governmental intervention. The sufficiency results from an assessment that the gains from the intervention outweigh the associated costs due to “government failures” (Tullock et al. 2002). Thus, there would be a trade-off between two inefficient outcomes, one generated by free markets (market failure) and the other by governmental intervention (government failure). The solutions advocated by Neo-Keynesians focus on correcting failures such as imperfect information (Stiglitz and Weiss 1981). Solutions advocated by Public Choice scholars (Buchanan 2003) focus on leaving resource allocation to markets (which may be able to correct their failures on their own). Broad categories of market failures can be described, according to the source of failure (and, hence, what needs “fixing”) and which condition of the FFT it violates. Each of these types market failures can be associated with one of the roles that SIBs play in the economy.

3.1. Countercyclical role

Capitalist systems are marked by business cycles (Schumpeter 1939; Perez 2002), when periods of economic prosperity are followed by periods of recession or crisis. In times of crisis, SIBs play a crucial role, as they supply countercyclical finance (liquidity) that would otherwise be in shortage due to the higher risk-aversion of private financial institutions. Thus, public investment provides short-term fiscal stimulus to keep the economy running.

The MFT justification of the countercyclical role is based on the notion that business cycles create an inter-temporal dynamic that lead to situations in which the economy follows a Pareto-inefficient path (Stiglitz 1974, 1991). In such situations, capital, labour and natural resources will be underutilised. Such coordination failures occur when agents are unable to coordinate their expectations and preferences throughout the business cycle, due to information asymmetries and high screening costs (agents do not know each other’s set of preferences and expectations and the costs of obtaining this information through screening the market are too high) or issues of free-riding (agents do not change their preferences/expectations for fears that other agents will benefit from their action). Both cases can be shown to violate the first condition of the FFT of welfare economics: there are no markets for information or for the externalities generated by an agent’s decision to change their preferences. Thus, markets will either not reach an equilibrium, or will reach a Pareto-inferior (suboptimum) equilibrium: supply will not match demand, workers will not find employment (unemployment equilibrium), new purchasing power and savings will not get invested.

From this perspective, the countercyclical role of SIBs would be a way to address a particular type of coordination failure that arises from private agents (such as banks and firms) being too pro-cyclical (lending and investing too much in the boom and too little in the bust), putting the economy on a downwards path and not realising that by increasing lending they would be helping the economy out of recession (Levy-Yeyati, Micco, and Panizza 2004). Therefore, MFT assumes that SIBs are “risk-neutral” and capable of absorbing risk during an economic crisis, spreading risk over time and cross-sectionally (Arrow and Lind 1970; Gutierrez et al. 2011). It is this assumption that justifies the countercyclical role of SIBs. For instance, in times of crisis, greater risk aversion of private agents may lead to underinvestment. To address this issue, SIBs may increase public investment to provide short-term fiscal stimulus to keep the economy running (Mankiw and Romer 1991). Their investments signal to the other agents’ confidence on the economy (thus addressing information asymmetries and issues of screening) and/or generate a positive externality to other agents (e.g. increase in effective demand).

3.2. Capital development (or developmental) role

SIBs also play important roles during periods of economic boom, promoting strategic investments for economic development. This was one of the original roles of many multilateral and national development banks, such as the IBRD (World Bank), JDB, KDB, BNDES and KfW. It is also the key role performed by export–import banks. Therefore, this role is not exclusive of SIBs from developing countries engaged in industrial catching-up, as could be expected. Indeed, despite Germany’s status as a developed economy, KfW still plays a developmental role, and the original funds from the Marshall Plan are still revolved and invested in promotional areas (KfW 2009). Also the United States, usually portrayed as the free-market economy par excellence, has an active export–import bank that for eight decades has supported the country’s exporting sector (Adams and Williams 2010).

Indeed, wherever private lenders have limited incentives to finance projects with “public good” characteristics (non-excludable and non-rival; often portrayed as instances of positive externalities), or in situations of imperfect competition, the market is not an efficient allocator of resources. These situations violate conditions (1) and (2) of the FFT, respectively, justifying public investments (through SIBs, for instance). Examples include private markets underfunding of goods with very high spill overs or socially desirable infrastructure projects with positive externalities; both are characterised by value that cannot be internalised by private agents. R&D investments generate new knowledge, which cannot be fully appropriated by the original investor (who cannot “exclude” other agents from using the knowledge to their own benefit). Thus, private agents tend to underinvest in R&D and innovation, because they cannot internalise benefits that would compensate for the development costs and make the investments worthwhile.

Market failures associated with industry structures (“competition failures”) are another rationale for the developmental role of SIBs. Competition failures arise when there are high natural barriers to entry (due to scale economies or network effects), which also lead to

Pareto-inefficient situations (Stiglitz 1991). SIBs provide funding in situations of monopoly and monopsony, in order to promote entry of new agents, increase the pool of producers and consumers, respectively, and foster competition. The particular case of support for exporting activities may be subsumed to a case of positive externalities (for which there are no markets), such as in cases where exports generate technological spillovers and learning (through the testing of goods and services in foreign markets).

Another market failure rationale for supplying export credit is to absorb risk that private financial actors are unable or unwilling to accept, a situation that violates FFT's condition 1 (markets for risks are incomplete). A final rationale for the support of exporting activities is to "level the playing field" and promote "competitiveness": to match financing and funding conditions that other governments provide to their own exporters, thus promoting competition in world markets. Thus, supporting the production of public goods and positive externalities (for example, provision of clean air or new knowledge) and addressing situations of imperfect competition (for example, natural monopolies, network effects, supply and demand-side economies of scale) are both key reasons for industrial policies and the associated capital development role of SIBs. In order to correct for these kinds of market failures, the state may implement horizontal policies to promote early-stage blue-sky research, infrastructure and other public works, enforce competition policies, regulate natural monopolies, establish early technical standards, provide export credit and so on.

What also links those sources of failures is that they all focus on using macro industrial policies to promote investments in public goods that are under-produced in prevailing market conditions or to tackle situations of monopoly and monopsony. SIBs are often the lead funding agent behind macro-industrial policy plans, both in developed and developing countries. SIBs sometimes fulfil their developmental role by promoting investments that seek to create a "national champion", which is at odds with the goal of addressing market failures due to non-competitive behaviour and may lead to a constrained Pareto efficiency equilibrium. Nonetheless, this is a type of investment that seeks to promote the entry of a new producer in the world market (see Section 4).

3.3. New venture support role

Investment in new ventures, such as SMEs and innovation development, has been the focus of some SIBs since the 1950s, but these activities have been intensified more recently, particularly the support for innovation (Griffith-Jones and Tyson 2013; Mazzucato and Penna 2015). Underlying the initiative is the fact that SMEs face difficulties in securing external funding due to a lack of guarantees and collaterals or of a track record of profitable investments. Innovation development also presents problems in securing external funding, due to the economic and technical risks and uncertainties that underlie the innovation process. In industrialised economies, SIBs are particularly important in helping to address the SME "funding gap", whereby small enterprises, especially start-ups that are highly innovative, lack both internal and external sources of funding for innovative projects. Therefore, another aspect of the funding gap is connected to innovation. Many SIBs have

programmes that do not target small firms per se, but those firms that are most innovative and engaged in technological development. The MFT justification of the new venture support or venture capitalist role is thus related to market inefficiencies at the micro level. An example is information failures arising from incomplete markets with high transaction costs and information asymmetries, such as unavailability of public information on bad vs. good borrowers (leading to adverse selection or moral hazard behaviours).

Such market failures create inefficiencies associated with non-equilibrium situations that result from the interaction between agents (microeconomic exchanges). For example, microeconomic Pareto inefficiencies may be caused by information asymmetries that lead to adverse selection of potentially good borrowers (Stiglitz and Weiss 1981); or they may be the result of high costs to carry out a transaction through markets (Coase 1960).

The classic example is the lack of finance/funding for small enterprises and start-ups, which usually lack a track record of good borrowing behaviour and are unable to offer guarantees for debt contracts. Another example is the lack of funding for R&D/innovation projects, which are risky and uncertain. Underinvestment in R&D projects due to information asymmetries can even occur in the presence of strong intellectual property laws, macroeconomic stability, free-trade and contract enforcement, because markets are “incomplete – there is no market for information – and agents may be stimulated to free-ride on each others’ efforts (Stiglitz 1991; Rodrik 2004). In these situations, SIBs’ investment in SMEs and innovation, through loans, equity or grants, would be justified in order to promote economic diversification, growth and development.

3.4. Challenge-led role

The challenge-led role of SIBs is informed by missions pre-defined in bold public policy plans that seek to address a societal problem or challenge, and, consequently, to transform a given sector or the whole economy of a country. One example is Germany’s “energy turnaround” (*Energiewende*), which seeks to phase out nuclear energy and fossil fuel and substitute them with renewable energy sources in order to tackle climate change, protect the environment (save resources) and promote energy security and safety. Other challenges that SIBs are tackling around the world are economic integration of underdeveloped regions and promotion of smart growth (BNDES), demographics and globalisation (KfW and EIB) and the transition to a “green” (environmentally-friendly) economy/ promotion of green investments (development banks of China, Brazil and Korea).

Such kind of investments to tackle societal challenges is often justified through MFT, as they seek to address negative externalities arising from the production or use of goods and services such as climate change, traffic congestion or antibiotic resistance, for which there is no market. Indeed, from a market failure perspective, most societal challenges are seen as negative externalities, a source of market failure that works at the system level, which would justify SIBs’ challenge-led (or systemic) role. The socio-economic system as a whole results in “costly” outcomes that are undesirable from a societal point of view. Negative

externalities are not reflected in the price system: there is no “equilibrium” price because there is no market (violation of FFT’s first condition).

For instance, climate change can be seen as a negative externality from carbon-intensive production methods or the burn of fossil fuels. Indeed, the Stern Review on the economics of climate change (Stern 2007) stated: “Climate change presents a unique challenge for economics: it is the greatest example of market failure we have ever seen” (Stern 2007, 1). SIBs’ mission-oriented investments would seek to internalise such external costs by promoting the development of new technologies and innovations that represent a “solution” to a given societal challenge. The challenge-led role can be also associated to market failures due to information asymmetries, as in the case where private agents lack the information about savings potential of energy efficiency investments. The kind of service-side measures provided by SIBs (as, for example, KfW’s advice service for businesses willing to invest in energy efficiency) also helps to coordinate expectations by signalling governmental support and commitment to addressing a particular challenge.

4. Towards a new ‘market-shaping’ conceptualisation of State Investment Banks

In this section, we will show the limitations of the market failure justification in explaining the increased role of SIBs, and develop an alternative framework based on notions from heterodox perspectives, which have either provided a critique of market failure theory or produced concrete insights on the roles of SIBs. Yet, these perspectives have achieved little systematic impact in the way state action is justified, formulated, implemented and evaluated. The key theories and concepts that we draw on include Keynes’ notion of socialisation of investments; Minsky’s stage view of capitalism (his concept of money manager capitalism) and proposal for community development banks; Schumpeter’s conceptualisation of economic development as a dynamic process; Polanyi’s view of markets as shaped and created by the state; Neo-Schumpeterian studies on microeconomic dynamics and the concepts of technological trajectories and techno-economic paradigm shifts in evolutionary economics (Dosi 1982; Perez 2002); mission-oriented policies in science and technology policy research (Fagerberg, Mowery, and Nelson 2005; Foray, Mowery, and Nelson 2012); developmental network state in development economics (Wade 1990; Amsden 2001; O’Riain 2004; Block and Keller 2011); and Mazzucato’s (2013a) entrepreneurial state.

By combining concepts from these theories, we aim to develop a qualitatively different typology that represents the seeds for a new theoretical framework of what SIBs do.

4.1. Countercyclical role

Recent cycles of boom-and-bust have been exacerbated by dysfunctional financial markets that focus on speculative gains even during periods of burst. Thus, the issue is not so much that private agents are risk-averse and preferences are pro-cyclical (as in MFT), but that

they became increasingly speculative over the past decades. The Post- Keynesian literature has showed that the type of financial structures in an economy (for example, the quantity and type of banks) is not inconsequential to the workings of the real economy and productive enterprises. Some structures are conducive to what Minsky calls the “capital development” of the economy, which includes privately owned capital equipment, technologies, skills and public infrastructure (Minsky 1992).

However, capital development is hampered when speculative finance targets low-risk, short-term gains through the trade of securities and other investments types that “[amount] to little more than pyramid schemes” (Wray 2012, 10). Minsky described the laissez-faire financial architecture that was established in the 1980s as “Money Manager Capitalism”, which he believed was inhibiting the “capital development of the economy”, because it led to speculation, short-termism, volatility, uncertainty and financial instability (Minsky and Whalen 1996; Papadimitriou and Wray 1998). So, the problem is not so much of risk aversion but of financialisation and speculation, which affect the countercyclical role as well as the other three roles of SIBs.

This situation, which has repeated itself in capitalist history (Perez 2002), does call for public policy intervention, which may take the form of a reform of the financial system and/or of innovation and fiscal policies (for example, through SIBs) – both of which were policies implemented in the United States with the New Deal, which was influenced by the ideas of Keynes. In the realm of fiscal policy, Keynes called for ‘socialisation of investments’ as “the only means of securing an approximation to full employment” (Keynes [1936] 2006, 246). However, Keynes was not so much concerned with underinvestment as he was with underutilisation of productive resources, particularly labour. The goal of his policy proposals was not to increase investments per se but to decrease unemployment. In this sense, “bailing out losers” could be justified, if the goal is to maintain jobs, for example.

In summary, while the need for public promotion of countercyclical credit is usually seen as resulting from coordination failures, SIBs actually do much more than just correct markets in this role. SIBs play an important short-term role of directing finance to productive opportunities, and in this sense, the countercyclical role provides the basis for all other SIB roles, laying the groundwork for the capital development of the economy, the full utilisation of labour resources, the creation of new technologies and sectors, and the direction of techno-economic change through challenge-led/mission-oriented investments.

4.2. Capital development (or developmental) role

In Schumpeter ([1912] 1934), economic development is a discontinuous endogenous process and results from investments in “new combinations”: new methods of production, new products, opening of new markets, new sources of supply and new forms of organisation – all of which disturbs the prevailing economic equilibrium. From the entrepreneur or the corporation point of view, the objective of introducing new combinations is the creation of “monopoly rents” (or “Schumpeterian rents”). Interventions

and investments that seek to address a market failure aim to bring the economy back to equilibrium of perfect competition, thereby “killing” Schumpeterian rents. This is at odds with Schumpeter’s view of economic development. In fact, in the “lost” seventh chapter of *Theory of Economic Development*, Schumpeter points to the limitation of the static perspective of mainstream economics that sees development as an exogenous process.

The limitation of the market failure view on the developmental role becomes more apparent when we look at the work of developmental economists studying catching-up and industrialisation processes (e.g. Prebisch 1950; Singer 1950; Hirschman 1958; Nurkse 1966). It was Abramovitz (1986), an economist more concerned with growth, productivity and business cycles in developed economies, who originally formulated the “catch-up hypothesis”:

“Countries that are technologically backward have the potential for generating growth more rapidly than that of more advanced countries, provided their social capabilities are sufficiently developed to permit successful exploitation of technologies already employed by the technological leaders. (390 – our italics)”

Key in this definition is the “social capabilities” qualification, a variable that is difficult to measure but includes technical competence and political, commercial, industrial and financial institutions (Abramovitz 1986). In fact, Prebisch (1950), Singer (1950), Nurkse (1966), among others, had theorised about problems of (the lack of) industrialisation, terms of trade imbalances, and insufficient availability of capital in underdeveloped countries, providing the foundation of active development strategies through governmental investments and policies (this view also justifies the support for exporting activities, which would help to diversify a country’s productive base and address these issues). From this perspective, economic development is not the result of natural (exogenous and ex-ante) competitive advantages, but of the endogenous creation of new opportunities that lead to the establishment of competitive advantages (Rodrik 2004).

Work on the developmental state has revealed the importance of the “visible hand” of the state in industrialisation and technological change (Wade 1990; Reinert 1999; Amsden 2001). More recently, this literature has also emphasised the developmental network state as being key: a decentralised network of different types of state agencies that can foster innovation and development. This requires the cost structure of an economy to be discovered in order to identify which types of goods and services that already exist in world markets can be produced in a domestic economy at low cost (Rodrik 2004). In line with this alternative view, SIBs play a central role in developing social capabilities, promoting capital accumulation, supporting the catch-up process and fostering technical change; in many instances, they also represent a “lead agency”, coordinating a network of actors in latecomer countries’ development efforts (Mathews 2006). In order to do this, a development bank/SIB may work as an agency to nurture knowledge development; invest in

infrastructure; promote strategic trade (such as import substitution, securing sources of materials) and financial leverage; prioritise investments in existing strategic sectors (reinforcing comparative advantages); create “national champions” that are able to compete in international markets; and provide coherence to economic policies (Reinert 1999; Mathews 2006; Etzkowitz and Ranga 2009).

While the need for some of these activities may be explained by market failure theory (for example, investment in public goods like knowledge and infrastructure), in fulfilling this developmental role SIBs do much more than just provide financial capital to fix failures. Because economic development is an endogenous process, they provide social capital¹⁴ for the development of social capabilities, coordinate initiatives and public–private partnerships, foster synergies and promote the introduction of new combinations that create Schumpeterian rents. In this sense, the developmental role of SIBs also underlies (and overlaps with) the roles of supporting new ventures and promoting challenge-led investments, both of which also require provision of social capital and, in the case of challenge-led investments, the development of shared visions (e.g. via industrial plans).

4.3. New venture support role

There are two key reasons why a focus on smallness, as implied by the market failure perspective on the new venture support role (small firms would be risky and lack guarantees to secure external funding), is misguided. First, Minsky suggested that one form that the Keynesian socialisation of investments should take, is of community development banks, which were established to fill the gap in banking and financial services for small firms and individuals in certain local communities (Minsky 1993). The ethos of community development banks was to promote the financial inclusion of certain strata of the society and certain regions, but this is not an end in itself, as would appear from a market failure perspective. Minsky was concerned with the capital development of the economy, which he conceived as the development of human capital and social capital. Therefore, the goals of community development banks that would execute the microeconomic role of SIBs are dynamic: the inclusion and development of individuals, firms and communities otherwise excluded from the economic system. Incidentally, this is often achieved through the provision of venture capital to small firms or microfinance to individuals.

Second, not all SMEs face a problem of capital supply due to adverse selection and moral hazard concerns. It is a myth that all SMEs are equal in terms of their propensity to innovate and grow (Mazzucato 2013a). There is no systematic evidence of a uniform relationship between firm size and growth (Haltiwanger, Jarmin, and Miranda 2013). Furthermore, small firms appear as less productive than larger ones, due to management issues (Bloom and Van Reenen 2007). The challenge for SIBs is not so much to provide abundant finance for all SMEs, but to find and nurture the so-called “gazelles” (Nightingale and Coad 2014); that is, young, high-tech firms that are SMEs. Nurturing this group requires as much financial capital (in the form of VC) as social capital (sometimes networking and co-management). Identifying the economic gazelles is akin to what Rodrik (2004) called the process of

“discovering” an economy’s cost structure and activities that can be profitably exploited to promote growth. Therefore, the microeconomic development role is also a type of industrial policy, as it complements the macroeconomic development role by selecting specific firms and projects that have the potential of generating Schumpeterian rents and economic development.

Moreover, economists working in the Schumpeterian tradition further theorised about technology development and innovation (“new combinations”) as an endogenous process to economic growth and development. Therefore, the issue is not one of “information asymmetries”, which assumes that some parts know the risks of an innovation project succeeding or failing. Innovation is a venture that is not only risky, but fundamentally uncertain, so no one knows the odds of success. Innovation requires financial capital, but the type of financial capital received affects the types of investments made (O’sullivan 2004; Mazzucato 2013b). In fact, innovation requires patient, long-term, committed financial capital (funding, in the Keynesian conceptualization). But from a market failure perspective, any kind of financial capital and even tax breaks would support high-tech SMEs and innovation development. The mutual causation between types of financial capital and investments is a key reason why SIBs have been increasingly mobilised to provide long-term committed venture capital for high-tech start-ups; that is, firms (usually small) that develop radical innovation projects. In this sense, the new venture support role also provides a basis for SIBs’ challenge-led investments that seek to promote radical innovations that address societal challenges.

SIBs’ “new venture support role” is akin to the actions of an entrepreneurial state. This concept, introduced by Mazzucato (2013a), builds on the notion of the “Developmental State”, but pushes it further by focusing on the type of risk that the public sector has been willing to absorb and take on. Mazzucato (2013a) describes the risk-taking role the state has played in the few countries that have achieved innovation-led growth, and shows that, in those countries, the state played a lead investment role across the entire innovation chain, from basic research to early-stage seed financing of companies to finance for commercialisation and market entry. This added focus on the type of risks taken by the state led Mazzucato (2013a) to conclude that ignoring the high-risk and uncertainty that the state has absorbed has caused the fruits of innovation-led growth to be privatised, even though the underlying risk was socialised that is, funded through taxpayers money. It is usually assumed that the returns to the state will occur through higher tax income. However, given that this return-generating system is broken, more thinking is needed on concrete ways in which direct mechanisms can be generated for the state to create a “revolving fund”, so that inevitable losses (caused by the uncertain nature of innovation) can be covered, and the next round funded – as is the case with private venture capital. SIBs provide a concrete mechanism through which “socialisation of rewards” can be achieved. This is because, in many of their new venture support investments they retain equity, so that if these venture investments are successful, they may result in windfall gains.

Moreover, even for its less risky investments, the use of loans (instead of grants, subsidies or tax breaks) provides another mechanism through which SIBs are rewarded.

4.4. Challenge-led role

From the market failure perspective, societal challenges are negative externalities that impose a cost to society that, by definition, is not reflected in prices. However, such a view is limited in its ability to explain what SIBs do to address societal challenges.

Science and technology policy research on mission-oriented initiatives (see below) provides an alternative and more complete conceptualisation of SIBs' systemic role because, in performing it, they go beyond addressing a market failure in order to internalise external costs. In this role, SIBs help to "make things happen that otherwise could not", as Keynes called for the state to do (Keynes 1926). More importantly, they pave the way for a "Great Transformation", as described by Polanyi ([1944] 2001), who showed that capitalists markets are deeply "embedded" in social and political institutions, rendering meaningless the usual static state vs. market juxtaposition. In their challenge-led role, SIBs are not simply fixing failures from markets; they are shaping and creating new technologies, firms and sectors, and, ultimately, markets – all of which will help to address a societal challenge.

A new great transformation, required to address the big contemporary challenges, will not arise from market forces, because markets are "blind", and even if they do not fail in a Pareto sense, they are incapable of providing a new, qualitatively different direction to economic development. The concepts of technological paradigms and technological trajectories (Dosi 1982; Nelson and Winter 1982) reveal the limitation of market forces in providing a direction to economic development. A technological paradigm has a threefold definition (Dosi 1982, 148): it is an outlook of the relevant productive problems confronted by firms (as producers of technologies or innovators); it represents a set of procedures (routines) of how these problems shall be approached; and it defines the relevant problems and associated knowledge necessary for their solution.

A technological trajectory, in turn, represents the direction of progress within a technological paradigm. Therefore, technology development is a problem-solving activity, and a technological paradigm "embodies strong prescriptions on the directions of technical change" (152). This is why market signals are limited in terms of providing direction to techno-economic development; they only work within the parameters of the paradigm, and therefore influence the rate of change more than its direction. When two or more technological paradigms compete, markets may influence which one is selected (the one which minimises costs). Once established, however, paradigms have a powerful "exclusion effect" whereby some technological possibilities are discarded because they are incompatible with the prevailing paradigm and are therefore "invisible" to agents. Thus, a techno-economic system of innovation may be locked into a self-reinforcing, path-dependent trajectory (Dosi and Nelson 1994). This becomes a problem if the trajectory being followed (or the paradigm itself) is inferior or suboptimal to what could be achieved

with technologies that transgress the paradigm (or with a different paradigm).

Perez (2002) expanded the notion of technological paradigm to techno-economic paradigm in order to account for the non-technological forces (economic and social institutions) that characterise certain periods of capitalist history and affect both the economic and social systems. Her theory of “techno-economic paradigm shifts” is a historical perspective on the long waves of development that accompany technological revolutions. When a new technological revolution emerges, the socio-economic system remains stuck within the bounds of the previous (socio) techno-economic paradigm, which means that market forces are incapable of directing the system towards a new one; consequently, the modernising and rejuvenating potential of the new revolution is stifled. In other words, there are mismatches between elements of the social-, techno- and economic systems (for example, social expectations, R&D routines, tax regimes, labour regulations, etc.). In order to overcome these mismatches, it is necessary to build new institutions that favour the diffusion of the new paradigm.

In all previous technological revolutions, governments have led the process of institution-building that allowed new techno-economic paradigms to replace the old ones. Perez (2002) specifically pointed to the role of public policy in allowing the full deployment of technological revolutions, such as the effect of suburbanisation on the ability of the mass production revolution to diffuse throughout the economy. Due to their experience and superior position in the economy, SIBs represent a concrete tool through which public policy can promote great transformations. In fact, this has happened in the nineteenth century, when industrial banks – the predecessors of modern SIBs – played a key role in providing the finance for the construction of continental European railway network (de Aghion 1999). This network totally transformed the socio-economic landscape to the point that Perez (2002) called the third technological revolution “the age of railroads”.

The stream of research on technological and techno-economic paradigms highlights the importance of cognition – rather than of “preferences” and “expectations”, as in market failure theory – when establishing the direction of technological change. Paradigms are powerful enabling and constraining institutions that favour certain directions of techno-economic development and obstruct others. In order to coordinate technoeconomic development towards a new, qualitatively different route, we need a paradigm shift that will avoid the constant renewal of prevailing trajectories, which happens if market forces provide directionality to the system. From this perspective, the challenge led role of SIBs concerns the creation of a new vision that will coordinate cognitive efforts of different (public and private) agents and direct their action to areas beyond the existing paradigm. It therefore complements the developmental role and the provision of social capital, which operates in long time frames, in that the vision (or what we will call “visionary capital”) provided by the challenge-led role is a mechanism to coordinate actions and expectations in the short-run.

Historically, innovation policies have created such a vision through the establishment of “missions” that gave a direction to techno-economic change. Previous mission-oriented policies were those driven by military or national security motives (such as those behind the origin of DARPA, the Defence Advanced Research Projects Agency, or NASA) and aimed to achieve clearly defined technical goals (creating a network of connected computers or putting a man on the moon). In recent years, there have been calls for a return to such policies to address “grand societal challenges” (see Mowery, Nelson, and Martin 2010). However, Foray, Mowery, and Nelson (2012) contrasted missions of the past, with such contemporary missions as tackling climate change.

While missions of the past aimed to develop a particular technology (with the achievement of the technological objective signalling that the mission was accomplished), contemporary missions have addressed broader and more persistent challenges, which require long-term commitments to the development of technological solutions. Thus, mission-oriented motivations have more recently been used to set up dynamic public agencies in other non-military areas such as energy security (ARPA-E, the US Advanced Research Projects Agency for Energy) and health (National Institutes of Health, NIH). By building on their accumulated capability and expertise in fulfilling the other three roles, SIBs seem well positioned to play a central role in the execution of new mission-oriented policies (Mazzucato and Penna 2015).

With this theoretical overview in mind, in the next section, we review the economic role and investment activity of 8 different State investment banks and also their relationship to governments with a particular focus on the potential for SIBs to support mission-oriented investment and innovation.

5. State Investment Banks: a comparative international review

The design of SIBs varies significantly between countries, as does as the political characteristics and the economic environments in which they act. The roles performed by SIBs, and their investment activities, also evolve over time in line with country-specific developments and challenges, as well as the wider institutional landscape. In this section, we draw on prior studies and data from several primary and secondary sources to compare the following features of eight SIBs from countries and regions across the world (six of which are European): mandate and mission; economic role; investment activities; risk and reward; and relationship to government policy. The SIBs we examine are as follows:

- **KfW:** KfW, formerly KfW Bankengruppe (banking group) is a German public bank based in Frankfurt. Its name originally comes from Kreditanstalt für Wiederaufbau (‘Reconstruction Credit Institute’) and was established in 1948 after the Second World War as part of the ‘Marshall Plan’ to support post-war reconstruction. Since then the development of KfW Group has been closely connected to the economic development of the Federal Republic of Germany. Today its activities include SME support, export promotion, environmental protection, innovation and international

development. In recent years KfW has been critical in supporting Germany's economic transformation to a green economy, both in terms of supply (through the support of green technology firms) as well as demand (through the financing of solar and wind power). In total KfW has provided more than one trillion euros in loans over nearly seven decades (KfW Group, 2018). In 2016 KfW Group held €507 billion (£409 billion²) of assets and employed over 6,000 people (KfW 2016).

- **European Investment Bank:** The European Investment Bank (EIB) is the financing institution of the European Union. The EIB was founded in Brussels in 1958 when the Treaty of Rome came into force. It relocated to Luxembourg, its current headquarters, in 1968. With assets of €573 billion (£462 billion) and 2,500 employees, the EIB is the world's largest multilateral borrower and lender by volume, and works closely with other EU institutions to implement EU policy. The EIB does this through "lending, blending and advising"; providing finance, complementing EU finance and giving advice on programme or project design (European Investment Bank, n.d). The EIB works closely with the other EU institutions, especially the European Parliament, the European Council and the European Commission.
- **Banco Nacional de Desenvolvimento Econômico e Social (BNDES):** BNDES is a Brazilian bank founded in 1952 to finance the construction of key infrastructure projects, expand industry and assist with the mechanisation of agriculture in Brazil. Although initially established to finance Brazil's catch-up strategies, over the course of the bank's history its operations have evolved in line with the Brazil's socio-economic challenges. BNDES' activities now include support for exports, technological innovation, sustainable socio-environmental development and the modernization of public administration. In recent decades, BNDES has had a catalytic role in promoting transformational investments in different phases of Brazil's development. In 2016 BNDES held R\$876 billion of assets (£181 billion) and employed nearly 3,000 people (BNDES 2016)³.
- **China Development Bank:** The China Development Bank (CDB) was founded in 1994 as a policy financial institution under the direct leadership of the Chinese State Council. The CDB is dedicated to supporting China's economic development in key industries and underdeveloped sectors. In its formative years the CDB struggled with high levels of non-performing loans, but in the 2000s the CDB transformed itself into one of the most active SIBs, investing in regional economic development and industrial catching-up, supporting and nurturing new ventures and innovation development, and, later in the decade, targeting finance to projects aimed at 'green growth' (Sanderson and Forsyth 2013). With assets of RMB 14,340 billion (£1,576

² All figures in this paper are converted to sterling using the average exchange rate for 2016.

³

billion) and nearly 9,000 employees, the CDB is the world's largest state investment bank.

- **Italy's Cassa Depositi e Prestiti:** The Cassa Depositi e Prestiti (CDP) was founded in 1850 for the protection and management of postal savings, investment in public works and the financing of government and public entities. The CDP has always played an important role in supporting household savings and promoting economic growth, but its sphere of activity has varied widely over the course of its history. Today the CDP is active across many areas including financing infrastructure, real estate, SMEs and strategically-important enterprises, and international expansion. In 2016 the CDP held €358 billion of assets (£289 billion) and employed just over 2,000 people.
- **Nordic Investment Bank:** The Nordic Investment Bank (NIB) is a multilateral bank established on 4 December 1975 through an intergovernmental treaty between Denmark, Finland, Iceland, Norway and Sweden. As of 1 January 2005, Estonia, Latvia and Lithuania became members of the Bank on equal terms with the original member countries. The aim was to set up an institution which could promote the integration of the Nordic economies which at the time were separated by tight regulation of capital markets. The NIB has lending operations both inside and outside its member countries, and offers long-term loans and guarantees on competitive market terms to its clients in the private and public sectors. In 2016 the NIB had assets of €30.2 billion (£24.3 billion) and employed 192 staff.
- **Bpifrance:** Bpifrance is a public investment institution established in 2012 through the merger of a number of existing public funds and organisations in France. It is described as “a public group aiming at financing and developing companies, and acting in accordance with the public policies conducted both by the State and regional authorities”⁴. In practice, Bpifrance plays the role of investment bank, innovation agency, sovereign fund and export credit agency (Bpifrance 2017). In 2016 Bpifrance had assets of €68.4 billion (£55.1 billion) and employed 2,500 staff.
- **Finnvera:** Finnvera is a specialised state-owned financing company and the official Export Credit Agency (ECA) of Finland. It aims to supplement private financial markets by providing businesses with loans, guarantees, venture capital investments and export guarantees. Finnvera was founded in 1999 through the merger of Kera Corporation, which provided loans and guarantees for domestic business activities, and the Finnish Guarantee Board, which provided export credit guarantees. The main objective of the merger was to improve the availability of financial instruments for Finnish companies through Kera's regional offices and to obtain economies of

⁴ Article 1 of Act No. 2012-1559 dated 31 December 2012 on the creation of Bpifrance

scale through the merger (Finnish Ministry of Trade and Industry 2004). In 2016 Finnvera had assets of €9.5 billion (£7.7 billion) and employed 376 staff.

In reviewing these SIBs, we adopt an exploratory methodology by use of an open-ended, qualitative case study approach. With this method, we seek to explore how the different design features of each SIB impacts the role that they play in their respective economies, and how this affects each bank's ability to successfully meet their mandates. For each design feature, we conclude with a discussion on how different approaches can affect both the challenges and opportunities of patient finance.

5.1 Mandate and mission

Most SIBs play a fundamentally different role in the economy to that of private financial institutions. However, not all SIBs have the same mandate or aim to achieve the same objectives. Any comparison of the role of SIB's in their economies must therefore be based on what they are actually trying to achieve. In this section, we review the mandate of each SIB as well as any mission statements or strategies that provide directionality to the activities of the bank.

5.1.1 KfW

KfW's legal mandate is set out in the 'Law Concerning Kreditanstalt für Wiederaufbau' as follows (KfW n.d.a):

1. Promotional tasks, notably financing, in pursuit of a State mandate in the following areas:
 - small and medium-sized enterprises, liberal professions, and business start-ups,
 - risk capital,
 - housing,
 - environmental protection,
 - infrastructure,
 - technical progress and innovations,
 - internationally agreed promotional programmes,
 - development cooperation,
 - other promotional areas specifically stated in laws, regulations, or published guidelines on
 - public economic policy that are assigned to KfW by the Federal Republic or by a Land.
2. Granting loans and other forms of financing to sub-national public authorities and special-purpose associations under public law.
3. Financing measures with purely social goals and for the promotion of education;

4. Granting other financings in the interest of the German and European economy. The tasks of KfW in this area include:
- projects in the interest of the European Community that are cofinanced by the European Investment Bank or similar European financing institutions,
 - export financings outside the member states of the European Union, the other contracting states of the Agreement on the European Economic Area, and states with official status as candidates for accession to the European Union.

The KfW's global mission is to: "support change and encourage forward-looking ideas – in Germany, Europe and throughout the world." Lending and promotional activities are focused on three pre-established missions, or 'megatrends' (KfW n.d.b):

- climate change and environmental protection;
- globalisation; and
- demographic change.

In addition to these three megatrends, KfW also supports a number of 'trend-independent promotional themes' which include combating poverty, general corporate financing (especially small and medium-sized enterprises) and start-up financing.

5.1.2 European Investment Bank

The mandate of the EIB is set out in Article 309 of the Treaty on the Functioning of the European Union (TFEU) which states that the task of the EIB is to facilitate the financing of the following projects in all sectors of the economy (European Investment Bank n.d.a)

- projects for developing less-developed regions;
- projects for modernising or converting undertakings or for developing fresh activities called for by the establishment or functioning of the internal market, where these projects are of such a size or nature that they cannot be entirely financed by the various means available in the individual Member States;
- projects of common interest to several Member States which are of such a size or nature that they cannot be entirely financed by the various means available in the individual Member States.

Guided by the objectives of the Europe 2020 strategy of smart, sustainable, and inclusive growth, the EIB's current mission is "to support the achievement of EU policy goals, acting as the EU's catalyst for change in the drive to become a yet more dynamic inclusive green knowledge-based economy". The EIB's activities are aligned to two over-arching policy goals of social and economic cohesion and climate action, and four "primary public policy goals" of innovation, SMEs and Mid-cap financing, infrastructure and environment. In the 2017-2019 operational plan, particular emphasis is placed on projects supporting migration,

youth employment, the digital economy and other innovation (European Investment Bank 2016).

5.1.3 BNDES

The legal mandate of BNDES is set out in legislation which states that “BNDES is the main instrument to implement and carry out the Federal Government’s investment policy, and its foremost purpose is to support programmes, projects, construction and services related to the country’s economic and social development” (BNDES n.d.a).

The legislation states that BNDES, directly or through subsidiaries, will carry out banking activities and financial operations of any kind, and in particular:

- finance economic development programmes, with the resources of the Social Integration Program;
- promote the application of resources linked to the PIS-PASEP Participation Fund, the Merchant Marine Fund - FMM and other special funds established by the Government;
- act as an agent of the Federal Government, the states, and municipalities, as well as of governmental agencies (autarquias), state-owned companies, mixed capital entities, state-owned foundations and private organizations;
- contract operations in Brazil or abroad, with foreign or international entities, being lawful to accept the form and clauses usually adopted in international contracts, including the commitment to resolve doubts and controversies by means of arbitration;
- finance the acquisition of assets and investments made by nationally-owned companies abroad, as long as they contribute to Brazil’s economic and social development;
- finance and promote the exportation of products and services, including installation services, which comprise expenses incurred abroad related to exports;
- make non-reimbursable investments in educational and research projects or programmes, of a scientific or technological nature, including by donating technical or scientific equipment and technical publications to institutions dedicated to implementing such projects or programmes, or which have received financial collaboration from the BNDES for that specific purpose;
- make non-reimbursable investments specifically earmarked to finance projects of a social nature, in the areas of employment and income generation, urban services, health, education and sports, justice, feeding, housing, environment, water resources, rural development and other areas in connection with regional and social development, as well as projects of a cultural nature in compliance with the regulatory rules issued by the Board of Executive Officers;

- contract technical studies and provide technical and financial support, including non-refundable, for the structuring of projects that promote Brazil's economic and social development;
- carry out, as an integral part of the National Financial System (Sistema Financeiro Nacional), any other operations in the financial or capital market, in accordance with the norms and guidelines of the National Monetary Council (Conselho Monetário Nacional); and
- use funds raised in the foreign market, provided that doing so contributes to Brazil's economic and social development, to finance the acquisition of assets and the implementation of projects and investments abroad by Brazilian companies, subsidiaries of Brazilian companies and foreign companies whose largest voting shareholder is, directly or indirectly, a natural person or legal entity domiciled in Brazil, as well as to acquire in the primary market securities issued by or under the responsibility of said companies.

In 2008, BNDES established a new mission to “foster sustainable and competitive development in the Brazilian economy, generating employment while reducing social and regional inequalities.” (BNDES (n.d.b.). As part of this new strategy, BNDES’ investments are guided by the interrelated themes that represent “the new challenges to be tackled”: innovation; socio-environmental development; and local and regional development, prioritising the less developed regions in Brazil (BNDES n.d.b.).

5.1.4 Finnvera

Finnvera’s mandate as defined in the Act on the State-Owned Specialised Financing Company (Parliament of Finland 1998) is as follows:

- to promote and develop the activities of enterprises, particularly small and medium-sized enterprises;
- to promote exports and internationalisation of enterprises; and
- contribute to the achievement of the State's regional policy objectives.

Finnvera’s operations are governed by policy goals determined by the Finnish State. Every four years the Ministry of Employment and the Economy sets policy goals for Finnvera. These goals apply to issues such as the offering of financial products, the focus of operations, the impact and efficiency of operations, and capital adequacy. Whenever necessary, these goals are adjusted yearly. When these goals are determined, attention is paid to the Finnish Government’s Programme, the Ministry’s corporate strategy, the policy objectives concerning the Ministry’s branch of administration, and the goals of EU programmes. Finnvera’s operations are also guided by its organisational vision and mission:

- Vision: Finnvera is a provider of financing for growth, competitiveness and internationalisation.

- Mission: By supplementing the financial market and by providing financing, Finnvera promotes the business of SMEs, the exports and internationalisation of enterprises, and the realisation of the State's regional policy goals.

5.1.5 China Development Bank

The CDB's purpose is to "serve national strategies" and its mission is to "enhance national power and improve the livelihood of the people" (CDB 2015). The CDB's Articles of Association state that the bank's business scope includes (CDB 2016):

- deposit taking from corporate customers;
- making short-, medium- and long-term loans;
- entrusted loans;
- making sub-loans with the support from small- and medium-size financial institutions;
- domestic and international settlement;
- acceptance and discount of negotiable instruments;
- issuance of financial bonds and other marketable securities;
- acting as agent for the issuance, repayment and underwriting of government bonds, financial bonds and debentures;
- trading in government bonds, financial bonds and credit bonds;
- interbank borrowing and lending;
- sale and purchase of foreign exchange on our own account or for customers;
- settlement and sale of foreign exchange;
- trading derivatives on our own account or for customers;
- letter of credit related business and issuance of guarantees;
- collection and payment agent and bancassurance business;
- safety deposit box services;
- asset management business;
- asset securitisation business;
- consultancy;
- banking business of our overseas branches authorised by us and permitted under local law;
- business such as investment and investment management, securities, financial leasing, banking and
- asset management legally carried out by our subsidiaries; and
- other business permitted by the banking regulatory authority under the State Council.

The CDB also has a set of core values which shape the bank's activities. These are (CDB n.d.a.):

- Responsibility: a commitment to serving national strategies and contributing to economic and social development in China
- Innovation: ensuring sustained and dynamic business development at the bank
- Green growth: support of green, circular and low-carbon development, incorporating the notion of “green credit” into all aspects of its business operations
- Prudence: development of risk management and internal control systems unique to CDB to ensure prudent business growth and balance the relationship between development, risk, and profit.
- Win-win development: a prerequisite for inclusive growth.

In line with these values, the CBD’s current objectives are to:

- Implement the national macroeconomic policies to drive coordinated development;
- Implement regional development strategy to realise coordinated and balanced development;
- Dedicate to green development and promote ecological civilisation;
- Carry out international cooperation to achieve opening up development (e.g. strategic cooperation in areas such as infrastructure with neighbouring countries); and
- Develop inclusive finance to aid sharing development (e.g. transformation of shanty towns).

5.1.6 *Cassa Depositi e Prestiti*

The CDP’s mandate has varied widely over the course of its history, and has changed significantly in recent years. The CDP’s current Articles of Association state that the corporate object of the bank is as follows (Cassa Depositi e Prestiti, 2003):

- the granting of financing to the State, the regions, local authorities, public entities and public law bodies;
- the granting of financing to public or private entities for public-interest initiatives; to support the international expansion of enterprises and exports; for international development cooperation activities; to banks operating in Italy to permit them to grant loans secured by mortgages on residential properties for the purchase of primary residences or for renovation; and energy efficiency enhancement works;
- the granting of financing, preferably co-financed with banks, for:
 - works, systems, networks and infrastructure to be used for public interest;
 - investments in research, development, innovation, protection and leveraging of cultural assets, promotion of tourism, environment and energy efficiency, green economy;
- the acquisition of shareholdings transferred to or conferred on the Company with the decree of the Minister for the Economy and Finance;

- the acquisition, including indirectly, of equity investments in companies of major national interest – having a stable financial position and performance and adequate profit-generating prospects – that meet the requirements established by the Minister of the Economy and Finance
- the purchase of:
 - bank bonds backed by portfolios of loans secured by mortgages on residential properties
 - securities issued as part of securitizations of loans to small and medium-sized enterprises, with a view to expanding the volume of lending to small and medium-sized enterprises.
- the management of Cassa depositi e prestiti's functions, assets and liabilities, outstanding prior to the transformation, as well as the management of any other public function and activity of general interest assigned by way of a legislative, administrative or private deed;
- the supply of assistance and consultancy services in favour of public and private entities;
- the supply of consultancy services and study, research and analytical activities in the economic and financial fields.

In February 2017, the CDP announced a new mission: “We promote Italy’s future by contributing to economic development and investing in competitiveness.” (SACE, 2017) This is supported by the following core values:

- **Accountability:** We act with full awareness of our role at the service of the country. We assess the economic, social and environmental impact of our actions from a long-term perspective.
- **Skills:** Our wealth of knowledge and experience is a distinguishing factor in promoting initiatives in the many areas in which we operate. We invest in our people on an ongoing basis.
- **Collaboration:** We believe in teamwork, in the ability to listen and the strength of dialogue. This is the spirit that guides us, at home and abroad, in our relations with our partners, be they institutions, companies, territories or the financial system, in Italy and abroad.
- **Courage:** We are determined in our decisions, even the most difficult. We operate responsibly, but without fear, when we are convinced that the path we have taken is the right one to achieve the best result for the community

The CDP is currently in the process of developing a sustainability strategy oriented around the UN Sustainable Development Goals, and that this will involve adapting the bank’s mission and core values in order to integrate sustainability principles. (Cassa Depositi e Prestiti. n.d.a)

5.1.7 Nordic Investment Bank (NIB)

The NIB's purpose as defined in its founding constituent documents is "to make financing available in accordance with sound banking principles and taking into account socio-economic considerations, to carry into effect investment projects of interest to the Member countries and other countries which receive such financing." (Nordic Investment Bank. 2017).

The NIB's vision is to create "a prosperous and sustainable Nordic-Baltic region", and its mission is "to finance projects that improve competitiveness and the environment of the Nordic and Baltic countries" (Nordic Investment Bank. n.d.). In order improve competitiveness of its member countries, the NIB finances projects that support productivity growth through:

- technical progress and innovation
- development of human capital
- improvements in infrastructure
- increased market efficiency

To improve the environment, NIB lends to projects that lead to:

- improved resource efficiency
- development of a competitive low carbon economy
- protection of the environment and its ecosystem services
- development of clean technology

5.1.8 Bpifrance

Bpifrance has two 'general interest missions' defined in law, which are to (Bpifrance 2017):

- promote and support innovation, particularly in the field of technology, and to contribute to technology transfer; and
- promote the development and financing of small and medium-sized businesses.

It also has a set of missions aimed at supporting sustainable growth, employment and competitiveness of the economy, which are that Bpifrance will (Bpifrance 2015):

- promote innovation, the priming, development, and internationalisation, transformation and transfer/buy-out of companies, by contributing to their financing through loans and equity financing;

- preferentially focus its action on female entrepreneurship, very small businesses, small and medium-sized businesses and intermediate-sized businesses, with a special focus on the industrial sector;
- invest prudently to finance long-term projects;
- support national industrial policy, in particular to support development strategies for industrial sectors;
- contribute to the development of growth sectors, conversion to digital technology and the promotion of a socially responsible economy;
- support the implementation of ecology- and energy-conscious transition measures; promotes the involvement of the banking system as a whole in the projects it supports;
- where necessary, conduct its activity in coordination with the European Investment Bank;
- provide a service and support offering for businesses to guide them throughout their development; and
- act to stabilise share ownership in competitive, high-growth major businesses supportive of the French economy.

5.1.9 Discussion

Most SIBs have their mandated sphere of activities set out clearly in law or in their Articles of Association, and it is common for these mandates to change and evolve over time. Many SIBs also have mission statements which provide directionality to the activities of the bank. Some SIBs are ‘challenge-led’ in that their mission and mandates are framed around specific societal challenges, whereas other are focused on more static outcomes such as ‘economic development’ and ‘competitiveness’ which do not signal a desired direction for the economy.

In all cases examined the mandate and mission statements are set by a combination of the government and senior management. One area for further exploration is how the definition of missions can be opened up to a wider group of stakeholders, including movements in civil society. Understanding more democratic processes through which missions are defined and targeted is tied to rethinking the notion of public value beyond the notion of the “public good” (Mazzucato, 2017). In the past, the public good concept has been used to limit and constrain the activities of public actors, creating a static distinction between those activities for business, and those for policy. This means that ambitious policies – daring to reimagine the market rather than just fixing the public good problem – have then been accused of ‘crowding out’ private activity, whether the accused are innovation agencies, public banks or the BBC (Mazzucato and O'Donovan, 2016).

But rethinking the notion of public value cannot be the work only of the public sector, hence opening up this process to include a wider set of stakeholders. Establishing new ways of

involving wider stakeholders in the definition of missions for SIBs, as well as the process of how to achieve them, has the potential to be an exciting future area of work.

5.2 Economic role

SIBs have played different roles throughout their histories, reflecting changing socio-economic circumstances and evolving stages of economic development. In this section, we assess the roles played by each SIB in their respective economies using the following typology developed by Mazzucato and Penna (2015b):

- **Countercyclical role:** In playing a countercyclical role SIBs direct finance to productive opportunities throughout the swings of business cycles, providing a counterbalance to the processes of financialisation and speculation. In this sense, this role provides the basis for all others; it underpins investments in the capital development of the economy, the full utilisation of labour resources, the creation of new technologies and sectors, and the direction of techno-economic change through mission-oriented investments
- **Capital development role:** SIBs' capital development role involves supply of capital to public goods areas such as infrastructure and new knowledge. In order to do this, a SIB may work as an agency to nurture knowledge development, invest in infrastructure, promote strategic trade (such as export finance, import substitution, securing sources of materials), prioritise investments in existing strategic sectors (reinforcing comparative advantages) and create 'national champions' that are able to compete in international markets.
- **Venture capitalist role:** Because the private sector does not often provide the long-term, patient finance that is required for innovation, SIBs have increasingly been mobilised to provide capital for innovative firms and start-ups.
- **Mission-oriented role:** In some cases, SIBs go beyond addressing market failures by promoting innovations that address key societal challenges, and making things happen that otherwise would not. Mission-oriented thinking requires understanding the difference between (1) sectors, (2) broad challenges, and (3) concrete problems that different sectors can address to tackle a challenge. Sectors define the boundaries within which firms operate, such as transport, health or energy. A challenge is a broadly defined area which a nation may identify as a priority (whether through political leadership, or the outcome of a movement in civil society). These may include areas like inequality, climate change, or the challenges of an ageing population. Missions, on the other hand, involve tackling specific problems, such as

reducing carbon emissions by a given percentage over a specific year period. They require different sectors to come together in new ways (Mazzucato, M. 2017).

5.2.1 KfW

The KfW plays all four economic roles discussed above, and each role roughly corresponds to the bank's group divisions. The Kommunal-und Privatkundenbank/Kreditinstitute and the IPEXBank are responsible for KfW's investments in capital development, infrastructure and exporting; the Mittelstandsbank is responsible for KfW's venture capital and innovation investments; and the Stiftung is fully concerned with mission-oriented initiatives and investments. All of KfW's divisions are guided by the three key challenges summarised in section 3.1: climate change and environmental protection, globalisation and technical progress and demographic change.

The fourth role – countercyclical – has been executed by the various KfW divisions, but since the Global Financial Crisis, has become an important aspect of the Mittelstandsbank's investments through the 'Special Programme'.

5.2.2 European Investment Bank

The EIB plays all four economic roles discussed above. It has played a key capital development role by financing key infrastructure projects and supporting industry, particularly in support of less-developed parts of the EU, and has been mobilised to play a major counter-cyclical role since 2012 to support the economic recovery in Europe (The European Investment Bank 2017). In 2012 the EU Member States decided to inject more capital into the EIB which meant that the EIB was able to lend an additional €60 billion at a time when private sector lending was contracting (Ibid).

The EIB has also played a growing venture capitalist role, in particular through its majority shareholding in the European Investment Fund (EIF), which facilitates access to equity for high-growth and innovative SMEs, and a new joint initiative called InnovFin which aims to facilitate and accelerate access to finance for innovative companies or projects that deal with complex products and technologies, unproven markets and intangible assets (The European Investment Bank 2017).

In supporting the EU's Europe 2020 strategy which outlines a vision of Europe based on smart growth (developing an economy based on knowledge and innovation), sustainable growth (promoting a more resource efficient and greener economy) and inclusive growth (fostering a high-employment economy delivering social and territorial cohesion) – the EIB is also playing a mission-oriented role (European Commission 2010). In particular, the EIB is playing a leading role in mobilising the finance needed to achieve the worldwide commitment to keep global warming below 2°C, and directs more than 25% of its total

financing to climate change adaptation and mitigation, supporting low-carbon and climate-resilient growth (The European Investment Bank 2017a).

5.2.3 BNDES

BNDES plays all four economic roles discussed above. BNDES has played a key capital development role by financing the construction of key infrastructure projects, expanding industry and assisting with the mechanisation of agriculture in Brazil – all of which have been crucial to Brazil’s catch-up strategy. Following the Global Financial Crisis BNDES also played a major counter-cyclical role by executing a major stimulus package to offset the effects of the downturn. In recent years BNDES has begun to play an important venture capitalist role, and many of BNDES’ venture capital investments are aimed at creating new technological landscapes and innovative solutions which fulfil a wider mission of achieving smart, sustainable and inclusive growth. As discussed in section 9.3, BNDES has developed an explicit toolbox for funding mission-oriented innovations. BNDES’ venture capitalist role forms the basis for a broader mission-oriented role.

5.2.4 Finnvera

In providing finance to SMEs, guaranteeing against risks arising from exports and helping to implement the government’s regional policy objectives, Finnvera plays a major capital development role. In March 2009, Finnvera introduced new ‘Counter-cyclical Loans and Guarantees’ to offset the shock of the Global Financial Crisis (Finnvera .2010), demonstrating a clear counter-cyclical role.

While historically Finnvera has played a venture capital role, in 2012 the Ministry of Employment and the Economy announced that Finnvera was to gradually give up its venture capital investments, with responsibility for the development of early-stage venture capital investments transferring to Tekes Venture Capital Ltd, another state-owned firm. While Finnvera does seek to promote economic growth, it does not actively seek to influence the direction of growth, and does not promote policies that target the development of particular technologies that address given societal challenges. It therefore does not play a mission-oriented role.

However, it is important to note that Finland has a number of other public agencies which do play this role. The most important of these is the public innovation agency SITRA (Finnish National Fund for Research and Development), which helped to transform Finland from one of the lowest-technology economies in the Organisation for Economic Co-operation and Development (OECD) into a global leader in information and communication technologies (ICT) industries (Breznitz, D. and Ornston, D. 2013).

5.2.5 China Development Bank

Since being established in 1994 the CDB has played a major capital development role. According to the United Nations, “from the time when the China Development bank was established in 1994 to the end of 2005, nearly 90% of its lending was directed towards infrastructure in eight key industries - power, road construction, railway, petro-chemical, coal mining, telecommunications, public facilities, and agriculture” (United Nations. 2005). Through these activities the CDB has played a key role in financing China’s catch-up strategy. The CDB is also explicitly expected to play a counter-cyclical role, with its website stating that it will “support counter-cyclical development at critical times” (China Development Bank. (n.d.b). In 2009, the CDB increased loans by 88% to provide a stimulus to offset the shock of the Global Financial Crisis (Qiyuan, X. 2017).

More recently the CDB has started to play a growing venture capitalist role, particularly through its investment arm, China Development Bank Capital Corporation Ltd, which specialises in growth capital, pre-IPO investments, mergers & acquisition, and restructuring. With its wider aim of promoting “innovative, balanced, green, open and inclusive development” (CDB 2016a), the CDB is now playing a mission-oriented role. In particular, the bank is the largest Chinese investor in environmental sustainability and green technology – at the end of 2016 the outstanding balance of green loans stood at RMB1.57 trillion, making the CDB one of the biggest green investors in the world (Ibid).

5.2.6 *Cassa Depositi e Prestiti*

The CDP has long been a key source of finance for public infrastructure projects, and therefore plays a capital development role. CDP has also played a counter-cyclical role, particularly throughout the recent Eurozone crisis when the bank increased its support for the Italian economy. In 2012 CDP invested more than €22 billion, the highest ever amount and an increase of 35% compared with the €16.5 billion mobilised in 2011. The target lending for the 2011-13 period was revised upwards from €40 billion to €50 billion, underscoring CDP’s counter-cyclical role (Cassa Depositi e Prestiti. 2012). CDP’s 2016-20 business plan commits to “pursuing a systemic and countercyclical approach” in its future investments (Cassa Depositi e Prestiti. 2017).

The CDP only started lending to businesses in 2009, and since then support has mainly focused on supporting strategic national enterprises and helping Italian firms compete internationally. CDP has acquired minority stakes in two small venture capital funds, however both are relatively new and small in scale. As a result, CDP does not yet have a major programme for providing patient, long-term committed venture capital for innovative firms. Similarly, while CDP does seek to promote economic growth, it does not actively seek to influence the direction of growth, and does not promote policies that target the development of particular technologies that address given societal challenges. However, the CDP is currently in the process of developing a sustainability strategy oriented around the UN Sustainable Development Goals, and this may involve adapting the bank’s mission and

core values, meaning that CDP may pivot towards a more mission-oriented role in future (CDP. n.d.).

5.2.7 Nordic Investment Bank

The NIB has played a capital development role by financing infrastructure, human capital development and SMEs, as well as a counter-cyclical role during downturns. However, the NIB does not play a significant venture capital role. This is partly because the bank does not offer equity instruments or provide venture capital for high-tech start-ups. While the NIB does promote innovation by financing R&D, this tends to be via long-term loans and guarantees to established firms, rather than venture capital or grants for more radical innovation (Nordic Investment Bank. 2015). It is notable that many of the Nordic nations have separate state-owned venture capital funds, for example Vaekstfonden (Denmark), Argentum and Investinor (Norway), Finnish Industry Investment (Finland) and Industrifonden (Sweden).

Despite not playing a venture capitalist role, the part of the NIB's mandate that focuses on enhancing the environment means that some of the bank's activities take on a mission-oriented character. The NIB actively supports the transition to a low-carbon economy by financing green investments in areas such as energy, public transportation and buildings. Crucially, the NIB's environmental investments are not sector specific, as is evidenced by support for greening traditional industries such as steel (Nordic Investment Bank. 2009). The percentage of NIB's outstanding lending volume allocated to climate change mitigation was 22% in 2016 (Nordic Investment Bank. 2017a). As such, while the NIB is not primarily focused on promoting radical innovation or developing new technological, landscapes, it is playing a mission-oriented role by directing its lending towards addressing a key societal challenge.

5.2.8 Bpifrance

Bpifrance plays all four economic roles discussed above. In providing finance to SMEs and guaranteeing against risks arising from exports, Bpifrance plays a major capital development role. Since being established in 2012 Bpifrance has invested counter-cyclically, playing a significant countercyclical role (Bpifrance. 2013).

Bpifrance also plays a major venture capital role by promoting innovation and investing in venture capital funds. By directing this innovation towards key societal challenges such as France's Energy and Environmental Transition (EET), Bpifrance also plays a mission-oriented role.

5.2.9 Discussion

All SIBs examined play a capital development and countercyclical role. In most cases, this was the original rationale behind their creation. However, in recent years – and particularly since the Global Financial Crisis – some SIBs have gone further and are now playing key venture capitalist and mission-oriented roles. By placing state investment banks at the centre of the investment process, countries like Germany and China as well as the European Union have taken centre stage in confronting the key social and environmental challenges of the 21st century. By steering the path of innovation towards overcoming key challenges, these banks are not just correcting ‘market failures’; they are actively creating and shaping markets and enabling activity that otherwise would not take place.

In assessing the economic role that each SIB plays in their respective economies it is important to consider the wider institutional landscape. The example of Finland is instructive. Both Finnvera and the Nordic Investment Bank operate in Finland, however neither play a mission-oriented role. But Finland has nonetheless been a pioneer of smart, innovation-led growth. This is largely due to the existence of a wider ecosystem of public institutions such as SITRA (Breznitz and Ornston, 2013).

This reinforces the idea of the ‘networked entrepreneurial state’ which is not comprised of one ministry or agency calling the shots top-down, but rather by a set of decentralised interactions between different agencies across the entire innovation chain, in turn interacting with private actors (Mazzucato 2017). It is this approach that has also been at the centre of US innovation and competitiveness (Mazzucato, 2013a; Block and Keller 2011). An area for further research is how SIBs can most effectively interact with other public agencies to drive innovation and address key societal challenges.

5.3 Investment activity

As with their economic role, the investment activities of each SIB have evolved over time and vary based on socio-economic circumstances and stages of economic development. In this section, we examine the investments that each SIB has made in recent years, as well as sectors that each SIB is active in. Where information is available, we also consider the types of customers served by each SIB, and whether they are served directly or indirectly via intermediaries.

5.3.1 KfW

Initially the KfW channelled investment in the housing, agricultural, power, and heavy industrial sectors in order to aid the reconstruction of post-war Germany. Beginning in the 1960s, KfW assumed more global responsibilities, and began providing financing for foreign

investments to secure primary commodities for German manufacturers as well as for international development aid projects. The KfW also began emphasizing SME financing, education, and more advanced industrial projects.

In recent decades, the KfW has expanded its activities into other areas such as housing efficiency projects and student loans, and has been instrumental in the reconfiguration of the German economy towards innovation and green technology. Today KfW's lending and promotional activities are focused on three pre-established missions, or 'megatrends' (KfW 2016):

- Climate change and the environment: KfW finances measures to support renewable energies, improve energy efficiency, safeguard biodiversity and prevent and/or reduce environmental pollution. To address the special importance of this megatrend, KfW has set an environmental commitment ratio of around 35 % of total promotional business volume. The KfW has played an instrumental role in the systemic greening of the German economy through the Energiewende policy, which aims to combat climate change, phase-out nuclear power, improve energy security by substituting imported fossil fuel with renewable sources, and increase energy efficiency⁵. The KfW 'Energy Transition Action Plan' was launched in 2011, which had invested over €100 billion by the end of 2016 (KfW 2016).
- Globalisation and technological progress: KfW contributes to strengthening the international competitiveness of German companies by granting loans in the following areas, among others: research and innovation, projects to secure Germany's supply of raw materials, and infrastructure and transport.
- Demographic change: KfW's objective is to address the consequences that result from a declining and aging population, including the following focus areas: age-appropriate infrastructure, vocational and further training, family policy and childcare as well as corporate succession.

In addition to these three megatrends, KfW also provides trend-independent general corporate financing (especially small and medium-sized enterprises) and start-up financing.

In 2016 KfW Group committed a total of €81 billion. Of this €55.1 billion was for financing German domestic development, of which €21.4 billion was SME finance and €33.7 billion was for municipalities and private customers. €24.9 billion was for international activities, of which IPEX represents €16.1 billion, KfW Development Bank represents €7.3 billion, and DEG represents €1.6 billion.

⁵ <http://iepd.iipnetwork.org/policy/kfw-financing-initiative-energy-transition>

Table 1: Promotional business volume of KfW Group, 2016

	Functional division	Activity	EUR in billions
Domestic business	Mittelstandsbank (SME Bank)	Environment and energy	10.7
		Start-ups and general corporate finance	10.1
		Innovation financing business	0.6
	Kommunal– und Privatkundenbank/ Kreditinstitute (Municipal and Private Client Bank/Credit Institutions)	Housing	20.8
		Infrastructure	4.1
		Education and social development	2.3
		Funding of promotional institutions of the German Federal States (Landesförderinstitute)	4.4
		Individual financing of banks	2.1
	Financial markets	Securitisation transactions	1.0
		Green bonds	0.3
International business	KfW IPEX-Bank	Export and project finance	16.1
	KfW Development Bank	Finance for governments, other governmental and non-governmental institutions in developing and emerging countries	7.3
	KfW DEG	Finance for private companies in developing countries and emerging economies	1.6
Total			81.0

Source: KfW (Ibid)

The KfW also has 'exclusion criteria' which prevent funding for projects which are likely to have unacceptable negative impacts on the environment, social conditions and governance. The criteria are as follows⁶:

1. Production or activities involving harmful or exploitative forms of forced labour or child labour as defined in the ILO core labour standards.
2. Production, use of or trade in pharmaceuticals, pesticides/herbicides, chemicals, ozone depleting substances and other hazardous substances that are subject to international bans.
3. Trade in animals or animal products that are subject to the provisions of CITES (Convention on International Trade in Endangered Species of Wild Fauna and Flora).
4. Production of cosmetics etc. involving testing on animals.
5. Commercial logging operations for use in primary tropical moist forests.
6. Production of wood or wood products other than from sustainably managed forests (enterprises with less than 50% FSC-certified production are excluded, FSC "Forest Stewardship Council").
7. Production or trade in controversial weapons or important components for the production of controversial weapons (anti-personnel mines, biological and chemical weapons, cluster bombs, radioactive ammunition, nuclear weapons).
8. Production or trade in tobacco.
9. Drift net fishing in the marine environment using nets in excess of 2.5 kilometres in length.
10. Controversial forms of gambling: operation of casinos, production of devices or other equipment for casinos or betting offices or companies that generate turnover via online betting. (So-called "short odds" are defined as "controversial forms of gambling").
11. Any business activity involving pornography.
12. Production or distribution of racist, anti-democratic and/or neo-Nazi media.

5.3.2 European Investment Bank

The EIB supports sectors that "make a significant contribution to growth, employment, regional cohesion and environmental sustainability in Europe and beyond" (European Investment Bank. n.d.b). The EIB's activities are currently guided by the objectives underpinning the EU's Europe 2020, which outlines a vision of Europe's social market economy for the 21st century, oriented around European Union (2010):

- Smart growth: developing an economy based on knowledge and innovation.

⁶ <https://www.kfw.de/nachhaltigkeit/KfW-Group/Sustainability/Sustainable-Banking-Operations/Sustainable-Investment/KfWs-Sustainable-Investment-Approach/Exclusion-Criteria/>

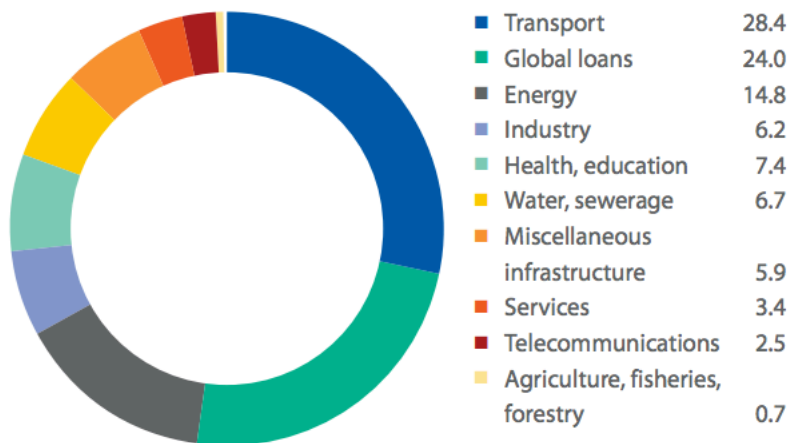
- Sustainable growth: promoting a more resource efficient, greener and more competitive economy.
- Inclusive growth: fostering a high-employment economy delivering social and territorial cohesion.

At present lending focuses on four priority areas (European Investment Bank. n.d.c):

- Innovation and skills: Investment geared towards innovation, skills and greater competitiveness is part of its mission to foster sustainable growth and jobs in Europe.
- Access to finance for smaller businesses: Financial products targeting small and medium-sized companies in order to drive of growth, innovation and employment in Europe.
- Infrastructure: Investment in infrastructure such as energy efficiency, transport, water and sustainable urban infrastructure to promote economic growth, sustainability and job creation.
- Climate and environment: Investment in climate change adaptation and mitigation, as well as improving the natural and human environment in areas such as biodiversity, clear air, clean water, sustainable transport, renewable energy and energy efficiency. In 2015 the EIB published its climate strategy which commits the bank to directing more than 25% of its total financing to climate change adaptation and mitigation, supporting low-carbon and climate-resilient growth (European Investment Bank n.d.d).

In 2016 the EIB committed a total of €76.4 billion, of which 90% was directed to EU member states. The distribution of this investment by sector is shown in figure 6.

Figure 6: Distribution by sector of the stock of loans at end of 2016 (%)



Source: EIB (European Investment Bank. 2016a)

Note: A global loan is a line of credit to an intermediary financing institution or a bank, which subsequently lends the proceeds, at its own risk, to finance small and medium-sized projects being undertaken by private or public-sector promoters

The EIB also produces a list of sectors that are excluded from EIB lending (European Investment Bank (2013):

- Ammunition and weapons, military/police equipment or Infrastructure;
- Projects which result in limiting people's individual Rights and freedom, or violation of human rights Projects unacceptable in environmental and social terms
- Projects in protected areas, critical habitats and heritage sites, without adequate compensation/mitigation
- Sex trade and related infrastructure, services and media; animal testing); gambling and related equipment, hotels with in-house casinos; tobacco (production, manufacturing, processing, and distribution); and
- Activities prohibited by national legislation (genetically modified organisms; abortion clinics; nuclear energy)

The EIB provides support to private businesses, public sector enterprises, investment funds and other financial intermediaries. It does not have private customers or provide financial services to individual people. The smallest loan it will provide is £25,000.

5.3.3 BNDES

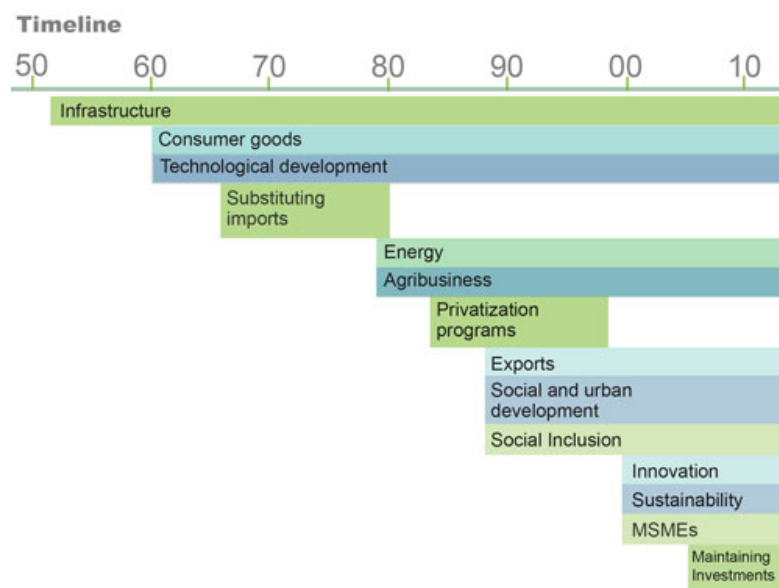
Initially BNDES invested heavily in infrastructure, but beginning in the 1970s the bank expanded into a number of other areas. Notably, the BNDES played a fundamental role in promoting a strategy of import substitution by encouraging Brazilian companies to compete

with imported products on the domestic market, and stimulating exports. In the 1980s, support expanded to energy sectors and agribusiness, and integrating social concerns with development policy.

In the 1990s, the BNDES emphasized its role in regional decentralisation through heavier investment in less developed regions in Brazil, as well as support for promoting exports among micro, small and medium-sized companies.

In the late 1990s BNDES began to promote environmental sustainability, and since then support for the green economy has dramatically increased. BNDES’ green investments include projects in renewable energy (biofuel, solar and wind energy), energy efficiency, sustainable transport (cargo and public, such as diffusion of electric and hybrid vehicles), and water, forest and waste management (including grants to local communities that protect their natural resources) (Mazzucato and Penna 2015).

Figure 7: Timeline on BNDES’ sectoral support

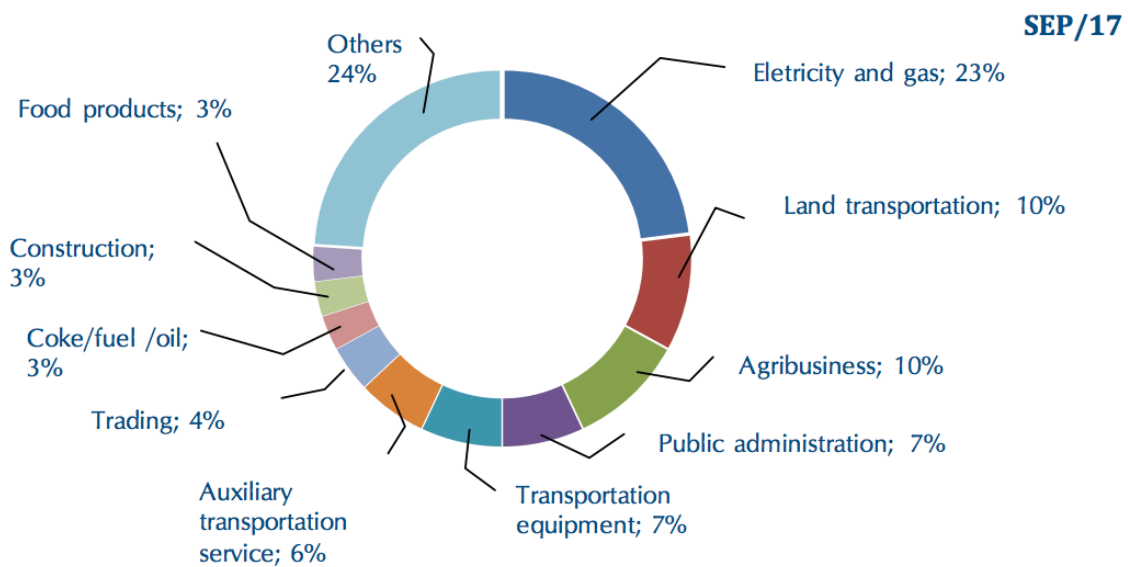


Source: BNDES (BNDES. n.d.d)

Today BNDES “aims at implementing, modernising or expanding undertakings of companies from almost all economic sectors. (BNDES. n.d.e)” The only economic sectors that cannot receive support from the BNDES are banking/financial activities, weapon trade, motels, saunas and establishments for adult entertainment, and gambling.

As at September 2017 BNDES’ loan portfolio stood at R\$ 562,812 million, spread across different sectors as shown in figure 8.

Figure 8: BNDES loan portfolio by sector



Source: BNDES (BNDES. 2017)

According to the Central Bank of Brazil, BNDES provided approximately 70% of long-term bank credit (defined as loans with over three-year repayment period) during 2013-15 (Frischatak et al. 2017). Some commentators have criticised BNDES for crowding out private sector bank lending and hampering the development of the local capital market, because BNDES' funding structure means that it is able to provide loans at subsidised rates (Financial Times. 2013). In a 2013 survey of the Brazilian economy the OECD stated that: "Further development of long-term credit markets is hampered by a lack of private participation, owing to an uneven playing field caused by strong financial support to the national development bank which dominates long-term lending." (Arnold et al. 2013) Others have argued that BNDES' competitive advantage is not due to its funding structure but because it operates with low loan spreads compared to traditional private banks, which focus on high-yield, short-term loan segments in order to maximise return on equity, and thus have little interest in expanding low-yield long-term financing for businesses (Rezende, 2015).

BNDES lends to private companies and individual entrepreneurs that are headquartered in Brazil, as well as public sector bodies. BNDES classifies companies according to their size, and the categories are applicable to all economic sectors. The classification by size is taken into consideration in specific financial support mechanisms of the BNDES, which are focused on a specific company size.

Table 2: BNDES company size classification

Classification	Annual Gross Operating Income
Micro Company	Less than or equal to R\$360 thousand
Small Company	More than R\$360 thousand and less than or equal to R\$3.6 millions
Medium Company	More than R\$3.6 millions and less than or equal to R\$300 millions
Large Company	More than R\$300 millions

Source: BNDES (BNDES. n.d.f)

BNDES has also been criticised for lending to large, profitable firms (Lazzarini et al. 2011). However, it is also true that some of the large Brazilian companies, like Embraer (aerospace), compete with large international competitors which receive large amounts of state support.

To apply for financing from the BNDES, the client is expected to meet the following minimum requirements:

- fiscal, tax and social obligations must be up-to-date;
- satisfactory registration must be presented;
- capacity to make payment;
- enough guarantees to cover the risk of the operation;
- client cannot be undergoing credit recovery;
- comply with legislation related to imports, in case of financing for imports of machinery and equipment; and
- comply with environmental legislation.

5.3.4 Finnvera

Finnvera's investment are currently made across three main business areas:

- SMEs and mid-cap financing: Finnvera's SME unit serves clients in a network of 15 branch offices covering the whole of Finland. It provides financing for enterprises at their start-up, growth and internationalisation stages.
- Large corporates: Finnvera's Large Corporates unit serves large export companies operating in Finland and is responsible for Finnvera's foreign risk-taking. It promotes Finnish exports by providing export credit guarantees and export financing solutions for enterprises and for banks that finance exports.

- Venture capital: Finnvera’s venture capital activities focus on the development of the existing portfolio of companies, follow-on investments and exits. However, in 2016 Finnvera gave up most of its venture capital investment activities following a policy decision made by Minister of Economic Affairs. Finnvera implemented this by selling 80% of its holding in Seed Fund Vera Ltd to the Finnish company Innovestor Ltd. Before the transaction, the investments made by using ERDF assets were placed into a separate fund called ERDF-Seed Fund Ltd. Finnvera continues to manage ERDF-Seed Fund Ltd through its subsidiary Veraventure Ltd.

Finnvera provides financing for most sectors, except for farming, forestry and building developer's business. It does not as a rule provide financing for real estate investments, construction or renovation of rental housing or companies operating in the financing, investment or insurance sector (Finnvera. n.d.a.).

5.3.5 China Development Bank

The CDB aims to promote investment in the following sectors (China Development Bank. 2016b):

- Economic and social development, including infrastructure, basic industries, pillar industries, public services and management;
- New urbanization, urban-rural integration, and balanced regional development;
- Programs vital for national competitiveness, including energy conservation, environmental protection, high-end manufacturing, and the transformation and upgrading of traditional industries;
- Public welfare, including affordable housing, poverty alleviation, student loans, and inclusive finance;
- National strategies including those in science and technology, culture, and people-to-people exchange;
- International cooperation, including the Belt and Road Initiative, industrial capacity and equipment manufacturing projects, infrastructure connectivity, energy and resources, and Chinese enterprises “Going Global”;
- Initiatives that support China’s development needs and economic and financial reforms;
- Other areas as mandated by and aligned with national development strategies and policies.

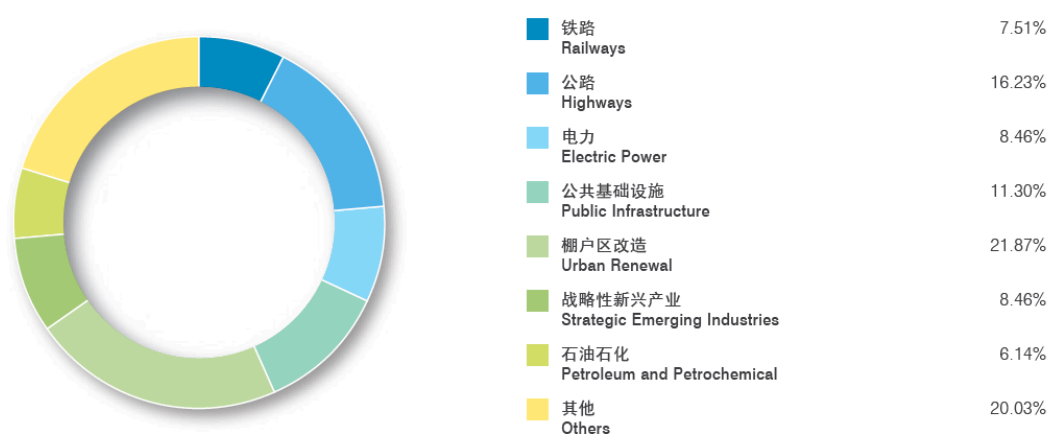
More recently, the CDB has targeted “innovative, balanced, green, open and inclusive development”. In particular, the bank is the largest Chinese investor in environmental sustainability and green development and incorporates the notion of “green credit” into all aspects of its business operations. In recent years CDB has dramatically increased green lending in areas including clean and renewable energy, green agriculture, green transportation, and industrial energy and water conservation. At the end of 2016 the

outstanding balance of green loans stood at RMB1.57 trillion (£178 billion), making the CDB one of the largest green investors in the world (Ibid).

The CDB has played a particularly important role in financing overseas activities of Chinese state-owned enterprises as part of China’s ‘going out’ policy. Its foreign currency loans have spanned more than 90 countries and regions around the world. The CBD does not support export and imports as this is the responsibility of a separate public bank, and the Export-Import Bank of China.

In 2016, total outstanding loans amounted to RMB 10,318 billion. The composition of lending is shown in figure 9.

Figure 9: Breakdown of total outstanding loans by industry, 2016



Source: CDB (Ibid)

5.3.6 Cassa Depositi e Prestiti

The CDP’s investment activity has varied widely over the course of its history, and has changed significantly in recent years. Between 1850 and 2003 CDP focused exclusively on making loans to Italy’s local authorities – a function that it continues to play today. In 2009 CDP was authorised to expand its activities to provide support for SMEs in the form of targeted funding through the banking industry, as well as for social housing. In 2012, the CDP Group was established after the Ministry of the Economy and Finance (MEF) acquired the companies SACE, SIMEST and Fintecna and transferred share ownership to CDP.

In 2014, the CDP Group’s remit was extended again to encompass investments in international cooperation, infrastructure, research and development, innovation, cultural

heritage assets, tourism, the environment, energy efficiency and the green economy. In 2015 the Italian government and the European Union assigned CDP the status of National Promotion Institution, meaning that it became the entry point for funding under the EU “Juncker Plan” and advisor to government entities for efficient use of domestic and European funds.

Today the CDP group is structured around four business areas:

- Enterprise: Investment to promote the start-up, innovation and growth of companies and sectors, as well as the reconstruction of areas affected by natural disasters.
- Infrastructure: Investment to support public infrastructure in areas such as transport and telecommunication.
- Real estate: Investments in the real estate sector, targeting in particular social housing projects and urban redevelopment.
- International expansion: Investment to support Italian enterprises with the dual aim of promoting export growth and expanding business operations beyond Italian borders. The CDP also supports the development of leading Italian companies in strategic sectors such as shipbuilding and the oil industry.

In 2016 CDP committed a total of €30 billion, which was allocated to each of the main business areas in the following proportions: 47% total to “International Expansion”, 35% to “Enterprises”, 17% to “Government and infrastructure”, and 1% to “Real Estate”

Table 3: New lending and investments broken down by business line, 2016

Business area	EUR in millions
Government and infrastructure	5.2
Enterprises	10.5
International expansion	14.2
Real estate	0.2
Total new lending and investment	30.1

Source: CDP (Cassa Depositi e Prestiti. 2016)

CDP’s clients are public bodies, businesses and households. The bank says that more than 10,000 public entities, 110,000 thousand companies and 11,000 thousand households have benefited from its programmes to support the economy (Cassa Depositi e Prestiti. n.d.b).

5.3.7 Nordic Investment Bank

The NIB assesses all potential loans internally according to their contribution to the bank's mandate. Only projects that contribute sufficiently to NIB's mandate fulfilment qualify for loan approval. The NIB has a lending ceiling corresponding to 250% of the authorised capital stock and accumulated general reserve, meaning that it cannot lend more than 2.5 times its capital base. A NIB loan or guarantee for a project should generally not exceed 50 per cent of the total cost of the project.

Investments are currently made across the four business areas:

- Energy and environment: investment in areas such as wastewater treatment, electricity transmission, distribution networks and smart metering systems, heat generation, hydropower, biomass and industrial energy plants.
- Infrastructure, transport and telecoms: investment in areas such as urban transport projects, airports, educational infrastructure and water supply facilities.
- Industries and services: financing industrial research and development programmes, corporate investments in production facilities and acquisitions and real estate construction.
- Financial institutions and SME lending: NIB provides financing to banks and other financial institutions, which act as financial intermediaries on-lending the funds to their clients. This enables NIB to reach out to smaller counterparts and projects that the bank cannot finance directly. The majority of such loans target small and medium-sized companies and renewable energy projects.

Table 4: New lending and investments broken down by business line, 2016

Business area	EUR in millions
Energy and environment	1,534
Infrastructure, transportation and telecom	1,198
Industries and services	912
Financial institutions and SMEs	720
Total new lending and investment	3,373

Source: NIB (Nordic Investment Bank 2017).

The NIB calculates the total net emissions of greenhouse gases for all the projects it finances, and assesses all potential loans internally according to its mandate to improve the

environment. The percentage of NIB’s outstanding lending volume allocated to climate change mitigation was 22% in 2016 (Ibid).

5.3.8 Bpifrance

Bpifrance’s investment activity is focused around three central pillars (Bpifrance 2017):

- Promoting French businesses: Bpifrance promotes the emergence of a fully integrated and effective ecosystem for financing and private investment in businesses. It aims to provide micro-businesses, SMEs and mid-caps with access to highly competent, specialized financiers and investors at all stages of development.
- Developing French businesses internationally: Bpifrance provides growing SMEs and mid-cap businesses with personalised international support, and along, with Business France, offers a package which facilitates access to information on foreign markets and tools for financing and insuring their export activities.
- Promoting new sectors and innovation: Bpifrance investments in growth sectors and sectors which support national industrial policy. This includes supporting France’s Energy and Environmental Transition as well as four ‘sectors of the future’: health and the living world economy, transportation, eco-industries, and digital (Bpifrance. 2014). Bpifrance invests across the innovation chain from the pre-R&D phase all the way through to the reinforcing of capital for established innovative firms.

In 2016 Bpifrance’s outstanding investments totalled €42 billion.

Table 5: Bpifrance outstanding investments, 2016

Subsidiary	Business line	EUR in billions
Bpifrance Financement	Credit	12.3
	Guarantees	8.4
	Innovation grants and loans	1.28
Bpifrance Investissement	Venture capital	0.191
	SMEs	0.139
	Mid-caps and large companies	1.1
	Funds-of funds	0.729
Bpifrance Assurance Export	Export credit	17.9

Source: Bpifrance annual accounts

Bpifrance Financement, the financing division, invests in many sectors, with most loans going to the transport, industry, real estate and constructions sectors (Bpifrance. 2017). Bpifrance Financement “networks” with banking and financial establishments, as well as

equity investors; competitiveness clusters, research institutions, universities, engineering institutes, major companies; SATT (Technology Transfer Accelerator Companies), public or private business incubators and start-up hubs; chambers of commerce, industry and skilled trades; chartered accountants; federations and professional trade unions; associations involved in company creation assistance and support networks; public and private actors working to distribute information technology.

Bpifrance Investissement, the equity investment division, invests across many different sectors of the French economy. There is a particular focus on growth sectors, particularly biotechnology, digital technology and energetic and ecological transition, and scale up operations.

Bpifrance assists businesses of all sizes, primarily micro-businesses, SMEs, and mid-caps; but it also assists large caps that are considered strategic in terms of national or territorial economy, or employment. Bpifrance supports SMEs through a decentralised network of 37 regional offices, being in direct contact with the entrepreneurs and their partners. 90% of decisions are being made at regional level. Bpifrance assists businesses of all sizes, primarily micro-enterprises, SMEs and mid-caps. It also assists large firms that are considered strategic for the national economy, territorial integrity or employment.

5.3.9 Discussion

The investment activities of SIBs vary between countries according to the bank's mandate, socio-economic circumstances and the country's stage of development. Some SIBs are active in a wide range of sectors, while others restrict their activities to certain areas. In some cases, SIBs specify the sectors and activities that they do not support. This can be due to moral or ethical concerns around the activities. Banks that play a mission-oriented role tend to invest strategically across many different sectors.

As with the economic role that SIBs play, wider institutional landscapes also affect each the investment activities of each SIB. In some cases, certain sectors are not supported by SIBs because they receive long-term financing from other public institutions in that country. For example, in Germany and China there are separate public banks dedicated to agriculture (Landwirtschaftliche Rentenbank and the Agricultural Bank of China), and in China and many of the Nordic countries there are separate public institutions dedicated to supporting exports and internationalisation such as the Export-Import Bank of China, EKN (Sweden), EKF (Denmark) and GIEK (Norway). While many SIBs are active in similar sectors, the emphasis put on each varies widely.

Some SIBs have been criticised on the basis of 'picking winners', 'crowding out' or funding large incumbent companies. While there are instances where criticism is merited, often it is not based on a rigorous evaluation of the available evidence. Part of the reason for this may lie in the absence of monitoring and evaluation frameworks which adequately capture the

dynamic outcomes of mission-oriented investments and the additionality generated by these institutions. As a result, new monitoring and evaluation frameworks may be required in order to assess the performance of mission-oriented SIBs, which could include an array of new indicators aimed at assessing the extent to which SIBs have been successful at catalysing activity that otherwise would not have happened (Mazzucato and Penna 2015).

Criticism can also be averted by avoiding focusing on firms of a specific size or in a specific sector ('picking winners'), and instead investing in firms that are willing to invest in innovation ('picking the willing'). A good example of this is Germany's Energiewende policy, which is not just about growing 'green' or new companies – it has required many sectors, including large ones such as steel, to transform themselves (Federal Ministry for the Environment, Nature Conservation, Building and Nuclear Safety (BMUB 2016)).

5.4 Risk and reward

Because innovation is uncertain, for every success there will likely be many failures. In some cases, returns arise slowly and are negative in the beginning, while in other cases returns never materialise. Acting as lead investor necessarily means absorbing a high degree of uncertainty and accepting failures when they happen.

This highlights the importance for SIBs to find the right balance between balance risk and reward, and of structuring investments across a risk-return spectrum so that lower risk investments help to cover higher risk ones (Mazzucato 2017). It also highlights the importance of being able to capture some of the reward (the 'upside') that is made possible by the risk-taking and investment of SIBs in order to cover the inevitable losses (the 'downside').

Some economists maintain that returns from public investment accrue to the public sector through the knowledge spillovers that are created, and via the taxation system due to new jobs being generated, as well as taxes being paid by companies benefiting from the investments. However, 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 (Mazzucato 2017a). 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.

In this section, we review mechanisms employed by SIBs to capture rewards to compensate for the risks being taken. These rewards can either be financial, for example from holding equity stakes in firms, or non-financial, for example by attaching specific conditions to loans and investments.

5.4.1 KfW

The main mechanism used by KfW to capture upside from supporting innovative firms is equity finance. As outlined in section 3.1, KfW has significantly increased its activities in the field of equity finance in recent years, and recently created a new subsidiary which will improve the venture capital offering for innovative technology-oriented enterprises in the start-up and capital-intensive early growth phase.

The KfW DEG, the subsidiary responsible for providing finance to private companies in developing countries and emerging economies, has also established an innovative framework to ensure that projects it supports makes a material contribution to development. KfW DEG uses its 'Development Effectiveness Rating' (DERa), a multidimensional index-based development metric, to rate the development contribution of potential projects before they receive investment, and then to monitor the performance of projects after they have received investment. The DERa is designed to assess contribution to the United Nations Sustainable Development Goals (SDGs), and includes data on the following five categories (KfW n.d.d.):

- Decent jobs
- Local income
- Market and sector development
- Environmental stewardship
- Community benefits

Based on these assessments, DEG is able to build its impact reporting and steer the overall development quality of its portfolio.

5.4.2 European Investment Bank

The European Investment Bank makes extensive use of equity finance to capture the upside from supporting innovative firms, mainly through its majority shareholding in the European Investment Fund (EIF) which facilitates access to equity for high-growth and innovative SMEs.

In recent years the EIB has also entered into a number of loan agreements with innovative companies which involve risk-reward sharing mechanisms. In 2014, the EIB put €75 million towards six drug development projects with Belgian biopharmaceutical company UCB to put up as part of a new 'at risk co-development funding' scheme set up under Horizon 2020 to finance R&D projects across Europe (European Investment Bank 2014). The scheme means that the EIB shares the risks and potential rewards inherent to drug development. The EIB invested directly in UCB's R&D expenditures relating to specified R&D programmes and over a specified time frame. Through this investment, the EIB acquired and co-owned (with UCB)

part of the intellectual property (IP) that would be jointly developed under the specified programme during the specified time frame. UCB was required to make payments to the EIB if and when predefined milestones were successfully achieved, for example if a pre-specified programme met its clinical endpoint or regulatory approval was obtained. At the end of the partnership, UCB will ultimately re-acquire all the co-owned IP.

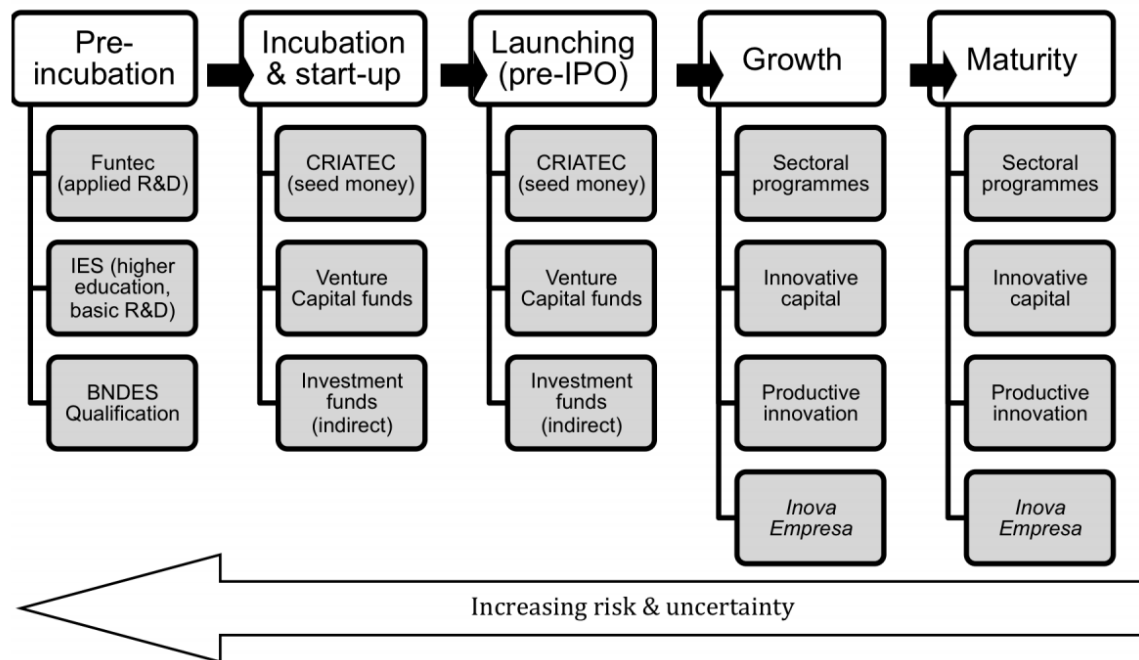
In 2017, the EIB provided €75 million to Evotec to invest in research and development of treatments for serious illnesses (European Investment Bank 2017). The loan is guaranteed by the European Fund for Strategic Investments (EFSI), the central element of the Investment Plan for Europe, the so-called 'Juncker Plan'. The EIB funding supports Evotec's Innovate strategy through a unique, innovative and flexible financing structure including a "moderate reward-sharing component" for the EIB. The €75 million total loan financing will be invested into R&D over a period of four years and will mature seven years after draw down. The transaction is the first large success-sharing investment under EFSI in any industry anywhere in Europe, and represents EFSI's first contingent investment, whereupon the bank shares the risk of its client's research & development (R&D) success.

5.4.3 BNDES

BNDES's strategy of making equity investments in innovative enterprises has established a strong link between risk-sharing and reward-sharing, helping to promote a type of risk-reward nexus that is conducive to the capital development of the Brazilian economy. The upside gained from successful investments contribute to BNDES's profits, which translate into dividends to the Brazilian Treasury and returns to Brazilian workers' social security funds (FAT).

As shown in figure 14, BNDES has developed a specific suite of innovation tools and programmes which focus on different areas of the risk landscape.

Figure 14: BNDES's funding programmes for different areas of the risk landscape



Source: Mazzucato and Penna (2015)

BNDES varies collateral and repayment obligations according to the risk/uncertainty of the project or investment. 1.5% of BNDES's profits go to specific, no-reimbursable funds for technology (FUNTEC), cultural, social and economic projects. The FUNTEC programme sees BNDES fulfil the role of angel investor, making non-repayable grants without any collateral requirements (Schapiro, 2012). The recipients of funds are only required to fulfil their technological mission and establish an intellectual property sharing agreement. BNDES's expectation is that the recipients return to the Bank for a loan repayable once the production of prototypes has been made possible.

In the case of small innovative firms in their incubation, start-up or launching stages, BNDES adopts innovation funding based on equity investments, and funding applications are evaluated in the light of potential future results rather than a firm's credit score. This requires BNDES to employ not only finance specialists but also experts in the sectors which it invests in. During these stages, BNDES also engages in the management and governance of the firm. Although BNDES does not hold majority stakes in these young companies, a standard condition attached to BNDES' funding is participation in the firm's board of directors and direct access to corporate information (Cherobim et al. 2011; Schapiro 2012). BNDES therefore not only acts as a financier but is also directly involved in development of firms' business plans until its IPO, which, is BNDES's preferred withdrawal option.

Since 2008, an important portion of BNDES' equity investments have taken place through the CRIATEC investment fund, which supplies seed capital for innovative start-up companies

that develop disruptive technologies in high-tech and new sectors. In contrast public R&D grants that are non-reimbursable, CRIATEC aims to achieve capital gains through long-term investment in early stage companies that have an innovative profile and offer high return prospects (Mazzucato and Penna 2015).

5.4.4 *Finnvera*

Finnvera used to play a significant venture capital role, capturing the upside from its investments from the development of new companies, follow-on investments and exits. However, in 2016 Finnvera gave up most of its venture capital investment activities following a policy decision made by Minister of Economic Affairs, selling 80% of its holding in Seed Fund Vera Ltd to the Finnish company Innovestor Ltd.

It is not clear whether Finnvera uses any tools to capture the upside of its investments beyond receiving interest payments on loans made. A recent review of Finnvera's activities found that the company would benefit from taking higher risks where potential rewards are big (Finnish Ministry of Employment and the Economy 2012).

5.4.5 *China Development Bank*

As discussed in section 9.5, the CBD makes equity investments through its subsidiary CDB Capital Corporation, particularly in support of technological start-ups and innovative enterprises. We have not been able to identify the conditions attached to the CDB's equity investments.

In 2014, it was reported that the CDB made a loan of RMB7.9 billion to a company called Quanlin Paper which was secured against a portfolio of 110 patents and 34 trademarks (Iam Media 2014). The deal represents an innovative approach to balancing between balance risk and reward, however because few details about the transaction are publicly available it is not possible to assess its impact.

5.4.6 *Cassa Depositi e Prestiti*

The CDP makes equity investments through its subsidiary arm CDP Equity. However, CDP Equity mainly acquires minority holdings in companies of significant national interest which are economically and financially stable and present adequate income-earning and growth prospects. It does not focus on early stage firms with great technological and growth potential. As of 2016 CDP Equity had invested a total of €3.7 billion in a portfolio comprising minority holdings in 11 companies.

The CDP publishes 'Corporate Governance and Responsible Investment Principles' which set out its expectations with regards to the corporate governance and social responsibility practices of companies it invests in (Cassa depositi e prestiti 2017a). These Principles inform

how CDP exercises its voting rights in the governance of companies it has a stake in, and concern the following topics:

- Shareholders responsibility and rights
- Corporate Governance Structure
- Remuneration
- Reporting, accounts and audit
- Sustainable Business Practices
- Engagement and communication

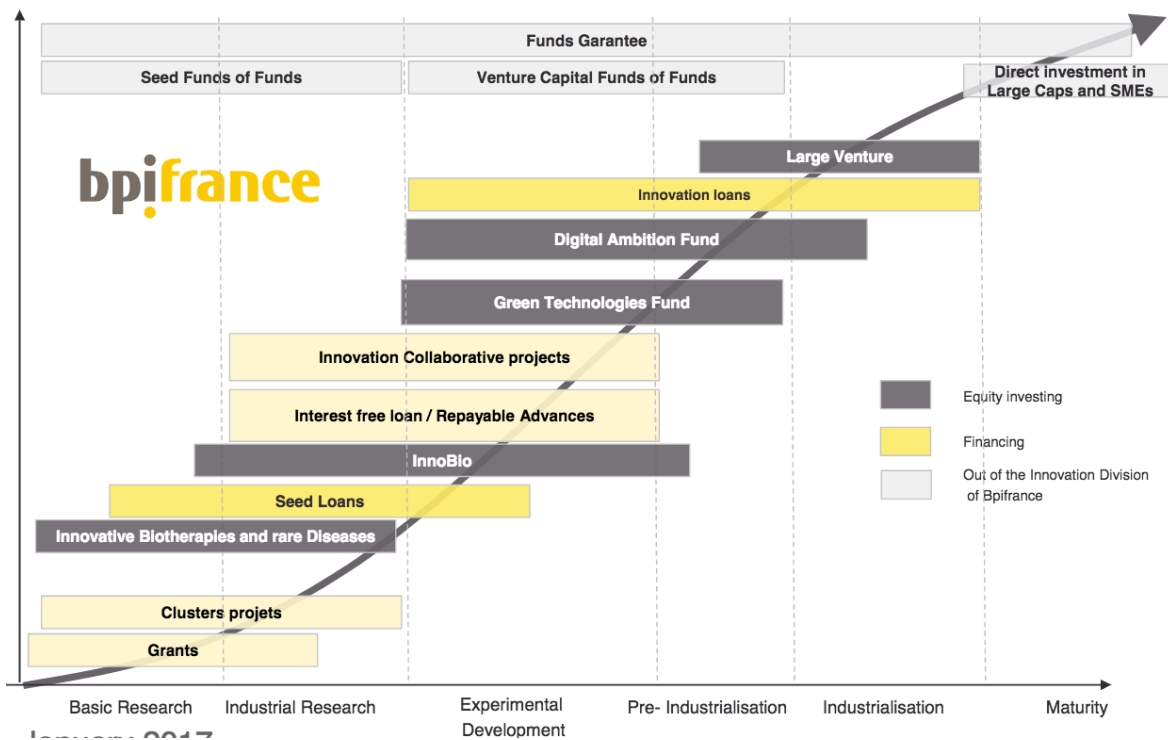
5.4.7 *Nordic Investment Bank*

As discussed in section 9.7, the NIB does not make equity investments. It is not clear whether the NIB uses any tools to capture the upside of its investments beyond receiving interest payments on loans made.

5.4.8 *Bpifrance*

Bpifrance employs a number of mechanisms to capture the upside from supporting innovative firms. The most significant of these is equity finance, which it makes through various programmes at different stages of the innovation chain.

Figure 15: Bpifrance innovation financing



Source: Bpifrance (Bpifrance. 2017a)

Bpifrance also has a number of innovative instruments which help to balance risk and reward. One of these is ‘profit sharing development loans’, which provide long-term finance to SMEs to fund the product launch phase. If the launch is successful and the product becomes profitable, Bpifrance receives a share of the profits.

Another instrument used by Bpifrance is ‘repayable advances’, which are similar to grants but which place an obligation on the beneficiary to repay all or an agreed part of the money under certain circumstances. Repayable advances can be viewed as a form of income-contingent loan.

5.4.9 Discussion

There is a strong case for arguing that, where technological breakthroughs have occurred as a result of targeted SIB interventions benefiting specific companies, the SIB should reap some of the financial rewards over time to cover the inevitable losses. Already some SIBs are employing mechanisms which enable them to do this. Firstly, many SIBs retain equity in the innovative companies they support, just as private venture capital firms do. Most SIBs do not hold a controlling stake, but some, such as BNDES, attach conditions to their investments such as having representation on the firm’s board of directors and access to corporate information.

Another mechanism used by some SIBs relates to the ownership of intellectual property. Some SIBs have established agreements which enable them to retain ownership of a small proportion of the intellectual property their support helped to create. For example, the EIB has entered agreements whereby it co-owns the intellectual property being developed by companies with the EIB's financial support, and BNDES often includes intellectual property sharing agreements in the conditions attached to its support. While an SIB should never hold a large enough proportion of the value of an innovation to deter its diffusion, there is a strong case that retaining ownership over some of some the intellectual property can help to create a healthy and symbiotic relationship between public and private, which reflects the public contribution.

Some SIBs have also tried to balance risk and reward by attaching specific conditions to loans and investments. Both the EIB and Bpifrance offer products whereby a company is only required to pay a loan or grant back if and when it makes profits above a certain threshold. These products are therefore similar in design to the 'income-contingent loans' received by students.

Lessons on how to achieve a more symbiotic and mutualistic type of public-private partnership can also be drawn from other fields. Bell Labs, one of the greatest private research and development (R&D) labs in modern history, owes its origin to the US government insisting that AT&T, a telecoms monopoly throughout much of the twentieth century, reinvested its profits back into production, innovation, and big innovation beyond that needed by the company (Gertner 2013). In doing so, the state received a social return for giving a monopoly right to the company: reinvestment creates greater spillovers. An area for further study is whether SIBs could attach similar conditions to investments to incentivise desirable corporate practice – including in areas such as employment practice and environmental impact.

Perhaps more radically, conditions could be attached regarding the price or design of products that emanate from SIB support. This may be of particular relevance in the case of sectors such as pharmaceuticals, which often rely heavily on public support (Mazzucato, M. 2013c). More work is required to establish which mechanisms are most effective at encouraging a symbiotic and mutualistic type of public-private partnership.

5.5 Relationship to government policy

SIBs are created in the first instance by governments, and in many cases governments continue to exert influence over features such as governance, ownership and sources of finance. However, an important consideration is the extent to which the operations of the SIB support wider government policy objectives. In this section we examine the extent to which day-to-day operations of each SIB are aligned with government economic and innovation policy.

5.5.1 KfW

KfW is tasked with implementing policy objectives of the German government, and receives the full financial backing of the federal government to do so which enables it to borrow cheaply on capital markets. The KfW works closely with the Ministries of the German Federal government in developing new promotional programmes and initiatives to ensure they comply with wider government strategies (Hubert and Cochran. 2017).

The KfW also regularly assists the government in selecting targeted policy areas and designing projects as well as financing them (Moslener et al. 2017). With its staff of technical experts, the KfW is well placed to provide objective advice to the government on the best way to achieve desired policy outcomes. This close operational relationship between the KfW and the German government creates a powerful synergy which means that policy, regulation and financing can be simultaneously coordinated for maximal societal benefit impact. Similarly, the KfW has on occasion complimented new government regulations (e.g. environmental regulations), with new financing instruments in order to transmit policy objectives more efficiently.

This close relationship between the KfW and government policy has been instrumental to the systemic greening of Germany's economy. By financing both the supply side (through the support of green technology firms) and the demand side (through the financing of solar and wind power) the KfW has been a key driving force behind the German government's Energiewende policy (Moslener et al. 2017).

5.5.2 European Investment Bank

The overarching role of the EIB is to finance investment projects that help implement EU policy objectives. In order to do this the EIB works closely with the other EU institutions, especially the European Parliament, the European Council and the European Commission. As outlined in section 4.2, the EIB's current activities are guided by the objectives of the Europe 2020 strategy of smart, sustainable, and inclusive growth.

In 2014, the EIB was tasked with helping to deliver the Investment Plan for Europe, sometimes referred to as the 'Juncker Plan' (European Commission. (n.d.a). The plan has three objectives: to remove obstacles to investment; to provide visibility and technical assistance to investment projects; and to make smarter use of financial resources. The EIB supports two key pillars of the plan:

- the **European Fund for Strategic Investments (EFSI)**, which provides an EU guarantee to mobilise private investment in projects which are strategically important for the EU (European Investment Bank. n.d.e).

- the **European Investment Advisory Hub** which provides targeted technical support to identify, prepare and develop investment projects across the European Union, thereby helping proposed investment projects become a reality (European Investment Bank. n.d.f.).

5.5.3 BNDES

BNDES has an explicit mandate to carry out government policy. The bank's basis in law states that BNDES "is the main instrument to implement and carry out the Federal Government's investment policy, and its foremost purpose is to support programmes, projects, construction and services related to the country's economic and social development." (BNDES. n.d.a).

The evolution of BNDES' targeted programmes have closely followed Brazilian government's industrial policy. In particular the Trade, Technology and Industrial Policy plan (2003 to 2007), the Productive Development Policy plan (2008 to 2010) and the Brasil Maior Plan (2011 to 2014) gave increasing emphasis to innovation and strategic sectors including IT, pharmaceuticals and health, oil and gas, defence, aerospace, and renewables.

BNDES has on occasion received criticism for allowing too much political influence over lending decisions, and offering favourable terms to politically connected clients (Lazzarini et al 2011).

5.5.4 Finnvera

The Enterprise and Innovation Department of the Ministry of Economic Affairs and Employment is responsible for the ownership and industrial policy steering of Finnvera. The Ministry of Economic Affairs and Employment supervises and monitors Finnvera's operations and sets goals for the company for a period of four years. These apply to issues such as the focus of operations, the impact and efficiency of operations, and capital adequacy. When determining these goals, attention is paid to the Finnish Government Programme, the Ministry's corporate strategy, the policy objectives concerning the Ministry's branch of administration, and the objectives of EU programmes (Finnvera 2016).

5.5.5 China Development Bank

The CBD's overarching purpose is to "serve national strategies" and the bank has an explicit objective to implement the government's macroeconomic policies. The CDB is actively involved in the planning and implementation of the Chinese government's Five-Year Plans, and works with relevant government agencies in the formulation of major national plans for strategic emerging industries.

In 2016, the CDB aligned its strategies and operations with the 13th Five-Year Plan of local governments, and developed provincial-level financing plans for 24 provinces and municipalities in the 13th Five-Year Plan Period and cooperation plans for 70 key regions, aiming to leverage its financing advantage to assist local governments to improve the feasibility and operability of their plans. The bank also conducted research on regional development, which resulted in a considerable number of province-specific and regional reports (Financial Times 2015).

5.5.6 *Cassa Depositi e Prestiti*

Historically the CDP's narrow sphere of activity has meant that it has played a limited role with regards to government policy. However, in 2015 CDP was declared a formal promotional bank, and Prime Minister Renzi appointed Claudio Costamagna, former chairman of Goldman Sachs in Europe, and Fabio Gallia, who was chief executive of BNP Paribas in Italy, as part of a wider strategy to get the CDP to play a more active role in the economy.

The CDP's new business plan for 2016-2020 includes €160 billion of investment across different areas of the economy (Financial Times. 2015). However, analysis of the plan has found no clear strategy in terms of links to a coherent industrial policy (Lucchese et al. 2016). As discussed in section 4.6, an open question is the extent to which this is related to the CDP's status as a joint stock company that has to give priority to profitability.

5.5.7 *Nordic Investment Bank*

As a multilateral bank spanning eight different Nordic and Baltic countries, there is no formal link between the activities of the NIB and the economic policy of the member countries. However, when assessing projects the NIB does consider the economic policy priorities of the country in question, and the bank maintains regular contact with each government owner. Moreover, the NIB's mandate can evolve over time reflecting changing government priorities. One example of this is that the bank is currently considering whether to add climate adaptation to mandate.

The NIB's founding statutes also state that investments in the member countries must be made in consultation with the authorities of the country concerned, who have a veto power over investments in their country (Nordic Investment Bank 2017). This means that in practice member countries can act to prevent specific investments if they are deemed to be in opposition to domestic industrial policy.

5.5.8 Bpifrance

Bpifrance's activities are closely aligned with the economic policy of the French state. Supporting national industrial policy is at the heart of all Bpifrance's missions, and it concentrates its interventions on the development of certain sectors or industrial fields which are seen as crucial to preserving or enhancing the competitiveness of the French economy (Bpifrance. 2014a).

Bpifrance is also at the heart of France's innovation policy, providing direct financial support as well as working closely with other stakeholders including research institutions, universities, engineering institutes, major companies, SATT (Technology Transfer Accelerator Companies), public or private business incubators and start-up hubs and the French chambers of commerce.

5.5.9 Discussion

Most of the SIBs examined have a formal duty to support government policy. Most do this by focusing lending on sectors or missions that have been prioritised through industrial policy.

In some cases, close alignment between SIBs and government policy has created a powerful synergy between policy, regulation and financing, which has been simultaneously coordinated for maximum impact. For example, In Germany new government policies have been complemented with new financing instruments in order to transmit policy objectives more efficiently. This close alignment between the KfW and government policy has been instrumental to the systemic greening of Germany's economy through the Energiewende policy (Moslener et al. 2017).

Although potentially powerful, this relationship is highly dependent on effective governance arrangements to ensure that sound banking principles around maintained and undue political interference is avoided. The case of BNDES serves an example of how allowing too much political influence over lending decisions can damage the reputation stature of a SIB (Lazzarini et al. 2011).

5.6. Summary and discussion of case study findings

We have presented an analysis of eight different SIBs, six of which were European and including the European Investment Bank, examining their mission, economic role, investment activities, risk and reward arrangements and their links to government economic

policy. While the institutional design of SIBs varies significantly between countries, a number of key lessons can be drawn:

- **Mandate and mission:** The overarching mandate is critical to the role that SIBs play in their economies. Mandates are often set out in law or Articles of Association, and often change and evolve over time. Mission statements can also play an important role in providing directionality to the activities of the bank. Some SIBs are ‘challenged’, with missions and mandates framed around specific societal challenges, whereas others are focused on more static outcomes such as ‘economic development’ and ‘competitiveness’ which do not signal a desired direction for the economy. An exciting area for future work relates to how the definition of missions can be opened up to a wider group of stakeholders, including movements in civil society. Understanding more democratic processes through which missions are defined can play a wider role in the process of rethinking the notion of public value.
- **Economic role:** All SIBs examined play a capital development and countercyclical role, however in recent years some SIBs have gone further and are now playing key venture capitalist and mission-oriented roles. By placing state investment banks at the centre of the investment process, countries like Germany and China as well as the European Union have taken centre stage in confronting the key social and environmental challenges of the 21st century. By steering the path of innovation towards overcoming key challenges, these banks are not just correcting ‘market failures’; they are actively creating and shaping markets and enabling activity that otherwise would not take place. An area for further exploration relates to how SIBs can optimally interact with other public agencies to drive innovation and contribute to the development of the kind of ‘networked entrepreneurial state’ that has been responsible for many great technological breakthroughs.
- **Investment activity:** The investment activities of SIBs vary between countries according to the bank’s mandate, socio-economic circumstances and the stage of development. In some cases, SIBs specify sectors and activities that they do not support due to moral or ethical concerns around the activities, or because the sectors are already served by other public or private institutions in that country. Some SIBs have been criticised on the basis of ‘picking winners’, ‘crowding out’ or funding large incumbent companies. Part of the reason for this may lie in the absence of monitoring and evaluation frameworks which adequately capture the dynamic outcomes of mission-oriented investments and the additionality generated by these institutions. As a result, new monitoring and evaluation frameworks may be required in order to assess the performance of mission-oriented SIBs, which could include an array of new indicators aimed at assessing the extent to which SIBs have been successful at catalysing activity that otherwise would not have happened. Criticism can also be averted by avoiding focusing on firms of a specific size or in a

specific sector ('picking winners'), and instead investing in firms that are willing to invest in innovation ('pick the willing').

- **Risk and reward:** SIBs must be able to strike the right balance between balance risk and reward, structuring investments across a risk-return spectrum so that lower risk investments help to cover higher risk ones. There is a strong case for arguing that, where success occurs as a result of SIB investment, the public sector should reap some of the financial rewards. It is often assumed that and when innovation is successful, a share in the gains will flow back to society through taxation. While this is right in theory, it does not always happen in practice due to changes in intellectual property regimes and tax avoidance. In order to ensure that both risks and rewards are shared fairly, SIBs can use a number of return-generating mechanisms, including retaining equity or royalties, retaining a share of the intellectual, using income-contingent loans, or attaching conditions to investments to incentivize desirable corporate practice. More work is required to establish which mechanisms are most effective at encouraging a symbiotic and mutualistic type of public-private partnership.
- **Relationship with government policy:** Most of the SIBs examined have a formal duty to support government policy. Most do this by focusing lending on sectors or missions that have been prioritised through industrial policy. Close alignment between SIBs and government policy can create a powerful synergy between policy, regulation and financing, which can be simultaneously coordinated for maximum impact. For example, new government policies can be complemented with new financing instruments in order to transmit policy objectives more efficiently. Although potentially powerful, this relationship is highly dependent on effective governance arrangements to ensure that sound banking principles around maintained and undue political interference is avoided.

6. Conclusion: how can the EU further boost patient finance?

This report has proposed that SIBs can help deliver mission-oriented investment and innovation policies via their market shaping and market creating role, moving beyond the standard 'Market Failure Theory' justification for their existence. The eight case studies of major SIBs discussed demonstrate the diversity of approaches to the design and role of SIBs in advanced economies, with some more successful than others. In this concluding section, we consider what steps the European Union could take to build upon the success of the EIB and other European national investment banks to meet the investment and innovation gap outlined in section 1. We also consider policies that might help to narrow the gap in investment and R&D spending between member states.

One clear option for EU policy makers wishing to boost patient finance would be an expansion in the lending and related supporting activities of the EIB. Although the EIB is one of the larger SIBs in the world, measured in terms of its assets as a percentage of EU GDP (4%) it is considerably smaller than either the Chinese Development Bank (19%) or the Brazilian BNDES (14%). The EIB's ability to leverage its own public financing to attract private co-investment enables a significant impact to be achieved from limited public resources. For example, an increase of €10bn in paid in capital by member states could generate an additional €160bn of lending assuming a 1:8 leverage ratio (the maximum that would enable the EIB to maintain its triple AAA credit status) and 50% private sector co-investment or national SIBs (Griffiths-Jones and Cozi 2016).

An expanded EU SIB lending program could be guided by a mission-oriented and market-shaping strategy as outlined in the European Commission's recently published report "Mission-Oriented Research & Innovation in the European Union" (Mazzucato 2018), which identifies 'grand challenges' facing Europe. The illustrative challenges identified in the *Missions* report include a plastic-free ocean by 2025, 100 carbon neutral cities by 2030 and halving the human burden of dementia by 2030. The EIB could focus on catalysing *new* activity and co-creating new markets to meet these kinds of challenges rather than subsidising ailing sectors. Indeed the main distinction between the CDP and the KfW, as outlined in section 5 above, is the way the former is mainly propping existing sectors or investing instead of the private sector, while KfW catalyses new activities, and co-invests with less use of subsidy.

By approach a more mission-led approach, the EIB and member states would also be going beyond the standard Keynesian counter-cyclical infrastructure investment role and this should be welcomed. Recent research suggests that such mission-oriented finance can have greater economic impacts than standard capital investment, generating a 'super-multiplier' effect by stimulating widespread innovation, crowding in private sector investment and directing the economy on to a new and more productive path (Mazzucato and Deleidi 2018).

Mission-oriented investment of this type would likely require investing across multiple sectors and working with existing institutions. The EIB could be placed at the centre of the pan-European investment process, nurturing knowledge and expertise and coordinating other stakeholders in the investment ecosystem, perhaps with a particular focus on supporting institutions and nascent SIBs in the southern Eurozone states.

In regard to the challenge of climate change, this approach is well aligned with the recently published EU High Level Expert Group report on Sustainable Finance (EU HLEG 2018) which calls for the establishment of 'Sustainable Infrastructure Europe' as a new capacity building organisation sitting within the EIB. This body would help to reduce bottlenecks holding back private finance by spreading best practice across member states on sustainable infrastructure projects.

Another policy option for financing mission-oriented innovation would be for greater coordination between the European Central Bank's monetary policy operations and the EU's broader social and economic policy goals, including sustainable and inclusive growth. The ECB is currently purchasing €30bn a month of sovereign and corporate bonds as part of its asset purchase program in order to boost inflation towards the 2 percent target (ECB n.d.). As of February 2018, total purchases had reached €2.4trn. The ECB's purchases have been criticised both because of the geographic distribution which largely favours the wealthier Eurozone states (the ECB has not purchased any Greek sovereign bonds) and because the transmission mechanism from the purchase of assets through to increased demand and inflation has been questioned. In particular it is unclear that investors or banks who receive ECB cash are adjusting their lending or investment portfolios in ways that support the real economy.

A variety of alternatives have been proposed for how the ECB could better align its asset purchases with wider EU economic and investment policies. One suggestion is that the ECB and Euro system (the combined member state central banks) should increase their purchase of bonds issued by the EIB and national state investment banks to support high growth projects in priority sectors (e.g. green infrastructure) in particular in the poorer Eurozone countries (see, *inter-alia*, Varoufakis and Holland 2012; Valla 2015; and Anderson 2015).

A sizeable percentage of the ECB's total asset purchases are corporate bonds - currently around €7bn per month. Utilities, the most carbon-intensive sector by emissions, make up the largest share of purchases the ECB makes at 16%. But renewable energy companies, already a relatively small portion of the bond market to begin with, are not represented at all in ECB purchases, while oil and gas companies make up an estimated 8.4 per cent and 1.8 per cent of their portfolios, respectively (Matikainen et al 2017). This partly reflects the makeup of the European bond market, and particularly the universe of bonds that meet the eligibility criteria of the programme, most of which support larger incumbent firms. The carbon-intensive skew of these purchases may disproportionately increase prices and encourage additional debt issuance in high-carbon relative to low-carbon sectors. By

adjusting their eligibility criteria in line with the Paris Climate Change agreement, to which the EU is a signatory, the ECB could help ensure greater support for transition to a low carbon economy (van Lerven and Ryan-Collins 2017).

Overall, the EU is well placed to meet the 'grand challenges' of the 21st century given its size and the existence of a number of successful SIBs. Europe's unique multilevel governance system is well suited to mission-oriented policies: member states and regions can experiment within larger EU-wide missions and the lessons can then be shared across member states. Already, there is clear evidence of the EU's SIBs moving well beyond the traditional Market-Failure Theory justification and embracing mission-oriented investment. Now is the time to upscale this activity further and ensure the EU is able to tackle the most complex challenges it faces with the support of committed, patient finance.

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