



Beyond market failures: the market creating and shaping roles of state investment banks

Mariana Mazzucato & Caetano C.R. Penna

To cite this article: Mariana Mazzucato & Caetano C.R. Penna (2016) Beyond market failures: the market creating and shaping roles of state investment banks, Journal of Economic Policy Reform, 19:4, 305-326, DOI: [10.1080/17487870.2016.1216416](https://doi.org/10.1080/17487870.2016.1216416)

To link to this article: <http://dx.doi.org/10.1080/17487870.2016.1216416>



Published online: 31 Aug 2016.



Submit your article to this journal [↗](#)



Article views: 1129



View related articles [↗](#)



View Crossmark data [↗](#)



Citing articles: 7 View citing articles [↗](#)

Beyond market failures: the market creating and shaping roles of state investment banks

Mariana Mazzucato^a and Caetano C.R. Penna^{a,b*}

^aScience Policy Research Unit – SPRU, University of Sussex, Brighton, UK; ^bInstitute of Economics, Federal University of Rio de Janeiro, Rio de Janeiro, Brazil

The paper develops a typological framework of the roles of state investment banks (SIBs) in the economy. The typology identifies four different roles: countercyclical; developmental; venture capitalist; and challenge-led. The paper conceptually elaborates the typology by first providing a historical overview of SIBs, and then discussing how the mainstream “market failure theory” justifies them. It then advances a different conceptualization based on insights from heterodox economics, showing that all roles of SIBs are more about market creating/shaping rather than market-failure fixing. The paper concludes with a proposal of a new agenda for research on SIBs based on our typological framework.

Keywords: state investment banks; public investment policy; market failure; development banking; mission-oriented policy

JEL Classifications: G20 (financial institutions and services general); O16 (economic development financial markets); O38 (technological change government policy); L52 (industrial policy); P16 (capitalist systems political economy)

1. Introduction: state investment banks as sources of mission-oriented funding for innovation

Recent years have witnessed state investment banks (SIBs) increasing their role in areas where the private sector fears to tread. This includes, for example, the emerging “green” economy: worldwide investments aimed at the global challenges of limiting carbon emissions. Figure 1 shows that in 2012, the share of development finance institutions (what we call SIBs¹) 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. This strand of research has focused on demand-side innovation

*Corresponding author. Emails: c.penna@sussex.ac.uk; caetano.penna@pped.ie.ufjf.br

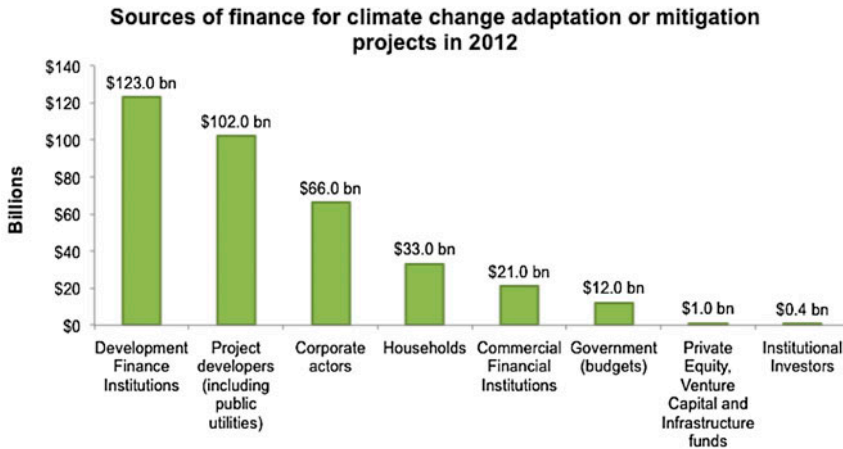


Figure 1. Finance for climate change adaptation and mitigation projects by source in 2012. Source: Based on data from Climate Policy Initiative (2013).

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; see also Edquist and Zabala-Iturriagoitia 2012). More recently, a special issue of *Research Policy* (Volume 41, Issue 10) has featured studies that looked at a limited number of financial (supply-side) tools, namely *non-reimbursable* public finance for basic research and innovation, such as grants (Sampat 2012; Wright 2012), subsidies (including tax credits; see Veugelers 2012) and innovation prizes (Murray et al. 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 new framework for research and innovation funding (EC 2011). 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 diversified their roles in the past three decades, going beyond traditional activities in both scale and scope. In so doing, they have promoted the following four types of investments: (1) countercyclical finance

to offset the credit crunch during economic recessions (Gutierrez et al. 2011; Luna-Martinez and Vicente 2012); (2) funding for long-term projects, industrialisation and capital development of the economy (Griffith-Jones and Tyson 2013); (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 (George and Prabhu 2003; Schapiro 2012; Hochstetler and Montero 2013; Sanderson and Forsythe 2013); and (4) promotion of investments around complex societal problems such as climate change and the ageing crisis (Schröder et al. 2011). The paper develops this new typology through which to understand the market *shaping and creating* roles of SIBs; a framework that goes beyond the usual emphasis on the “market-failure fixing” role of public sector activity.

The standard market failure framework used by economists to inform the formulation and evaluation of public investments, in general (and by SIBs, in particular), is problematic because it explains public intervention in the economy only if it is geared towards the correction of different types of “market failures”. Market Failure Theory (MFT) calls for specific structures for public agencies (insulation from private interests in order to avoid particular types of “governmental failures”) and specific evaluation exercises (static cost–benefit analysis). The market failure justification for public intervention and associated toolkit has placed SIBs under increased scrutiny and, in some cases, criticism (e.g. Pearson 2012; Lisboa and Latif 2013; Mussler 2013), because any role beyond fixing market failures is seen as unjustified. This paper argues that the market failure framework is too limited to understand the enhanced roles that public financial institutions – and SIBs in particular – have had to play due to the increased short-termism and speculation of private finance, because it ignores the role that the state has played from the beginning of capitalism in *shaping and creating* markets (Polanyi [1944] 2001).

In fact, the market failure rationale for the roles performed by SIBs is a relatively recent development that came about in connection to the rise of “neoliberalism” in the 1970s–80s and its dominance over public policies in the decades that followed.² The need to justify *ex-ante* the need for a public intervention due to the existence of market failures – and only in such cases – creates limitations to what SIBs can or should do. Yet, SIBs are not market failure fixes: they are powerful policy and political tools to direct resources to priority and strategic areas that contribute to economic development and growth. In this sense, the paper creates a typology that can explain and help us better understand the importance of SIBs as a powerful policy institution. We take inspiration from the works of Keynes (1926, 1980, [1936] 2006), Schumpeter ([1912] 1934, 1939, [1912] 2002), Minsky (1992, 1993; Minsky and Whalen 1996) and Polanyi ([1944] 2001) and draw specifically on the insights from heterodox economics literatures, which are more pertinent for describing the process through which public policy actively shapes and creates markets. Key concepts that we mobilise are: *technological trajectories* and *techno-economic paradigm shifts* in evolutionary economics (Dosi 1982; Perez 2002); *mission-oriented investments* in science and technology policy research (Fagerberg, Mowery, and Nelson 2005; Foray, Mowery, and Nelson 2012); *developmental network state* in development economics (Wade 1990; Block and Keller 2011) and the *entrepreneurial state* (Mazzucato 2013a). Our contribution is to apply these literatures to the study of SIBs (heretofore never done) and to more generally use them to propose a different lens through which to view the *market creation and shaping* process of public policy.

The remainder of this paper is structured as follows. Section 2 provides an historical overview of the roles that SIBs play in the economy, through which we identify the four roles cited above: countercyclical, developmental, venture capitalist and promotion of investments that help to address societal problems (or challenges). In Section 3, we present the market failure justification attached to each role. Section 4 introduces concepts from heterodox literatures to show the limitations of MFT and to provide the basis for an alternative theoretical typology. The concluding Section 5 summarises and contrasts the mainstream perspective with our alternative conceptualisation, and proposes avenues for a new research agenda that goes beyond MFT.

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.³ The second, in 1951, was the *Japan Development Bank*, the initial foci of which were development of heavy industries and infrastructure (including electricity).⁴ Another development bank, founded a couple of years later (1953), was the Brazilian *Banco Nacional de Desenvolvimento Economico e Social*⁵ (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.⁶

In subsequent decades, SIBs diversified their operations and foci. 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.⁷ 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 contemporarily⁹:

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

3. The four roles of SIBs: the theoretical justification of 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.¹⁰ 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.¹¹

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. As we explain next, 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 intertemporal 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 spillovers 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.¹²

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 asymmetries¹³ 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 framework and typology: the roles of SIBs from heterodox economics perspectives

In this section, we will show the limitations of the market failure justification in explaining the increased role of SIBs, and start to 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 has been 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. As Tcherneva notes:

Public investment is a direct approach to reducing unemployment. Add to that the secondary employment effects produced by the multiplier effect and we can estimate how much public-works spending is needed to close the [labour] demand gap. Whenever Keynes spoke of how much national income and expenditure are needed to maintain full employment, his “calculations are in terms of equivalent men ... and women, if they are unemployed ...” (Keynes 1980, 298). (Tcherneva 2008, 18)

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:

Our most important result is that such economic development really exists. [...] This conception is the contrary of an alternative explanation which can be expressed as follows: an economic equilibrium, once attained, will be maintained, as long as there is no disturbance coming from the outside. [...] According to this conception the purely economic plays only a passive role in development. Pure economic laws describe a particular [behaviour] of economic agents, whose goal is to reach a static equilibrium and to re-establish such a state after each disturbance. [...] It is true that this way of thinking corresponds to the fundamental principles of static economics. It allows for the precise formulation of static laws ... Yet we maintain that the conception described is not sufficient to explain the real development of the economy. (Schumpeter [1912] 2002, 96–97)

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; Etkowitz 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 capital*¹⁴ 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 micro-finance 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 would 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 techno-economic 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 *Defense 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*

Table 1. Analytical framework: characteristics of different functions of SIBs.

	Countercyclical role	Developmental role	New venture support role	Challenge-led role
<i>Market failures</i>	Coordination failures	Public goods, network externalities	Information asymmetries, adverse selection	Negative externalities
<i>Market failure limitation</i>	Not just underinvestment and risk-aversion: underutilisation of labour and financialisation	Not just infrastructure and knowledge: Schumpeterian rents, capital development and social capabilities	Not just SMEs and tax breaks: community development banks in support of <i>gazelles</i> and R&D/innovation development; discovery process	Not just internalising costs: Making things happen, great transformations; blindness of markets
<i>Beyond</i>	Smoothing the business cycle: employment, multiplier effect, socialisation of investments	Economic planning, strategic trade, national champions, social inclusion, structural and technical change, regional development,	Entrepreneurship, technical innovation	Addressing societal challenges; creating visions through missions; shaping and creating markets
<i>Type of capital</i>	Financial capital (finance, liquidity)	Social capital	Venture capital	“Visionary capital”

Source: Authors' elaboration.

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). Therefore, analysis of how SIBs fulfil their challenge-led (or mission-oriented) role represents a new and important research agenda, given the pressing need to carry out investments that promote smart, inclusive and sustainable growth and tackle societal challenges.

5. Conclusion

The importance of SIBs in the economy, particularly for transformative goals, is increasingly evident.¹⁵ In particular, SIBs represent an important alternative to “old” mission-oriented funding mechanisms. In a time in which many countries are trying to not only stimulate growth but to address key societal challenges, SIBs seem well positioned to effectively promote the much needed capital development of the economy in a smart, inclusive and sustainable direction. In this sense, analysing, theorizing and constructively criticizing what is being done is a new agenda for economists, and we believe our novel typology represents a first step in this direction.

Table 1 summarises our discussion in the previous sections into a synthetic typological framework, which, we argue, provides the seeds for the development of a new *theoretical* framework. Row 1 summarises our discussion of how market failure

theory justifies what SIBs do and should do. Rows 2, 3 and 4 of the table summarise our discussions of the limitations of MFT and of alternative conceptualisations provided by heterodox theories. Note that this framework table is an “ideal type”; what SIBs actually do in reality often overlaps. Furthermore, as we made explicit in our discussion in Section 4 and indicated in the fourth row, each role builds on or overlaps with the previous one, so that, for example, the challenge-led role requires the provision of visionary, venture, social and financial capital (and long-term funding). As such, aspects theorised by one author are relevant for more than one role. However, based on our discussion of MFT and heterodox theories, we claim that these four roles can be seen as conceptually different.

Different justifications for the investments carried out by SIBs inevitably affect the tools that are used to evaluate and assess such investments. If we move away from a market fixing justification towards a market shaping/creating role, it is essential to reconsider how such a different framework affects the evaluation of public investments and, therefore, related criticisms. While such criticisms highlight important issues, they are primarily the consequence of a limited perspective, and must therefore be reconsidered in order to take into account the empirical evidence and alternative theories and concepts.¹⁶ We propose three areas for future research that would help address such criticisms and therefore to advance the proposed typological framework. These areas represent a new research agenda for evolutionary, innovation and developmental economics:

- (1) *Development of indicators that help evaluate each of the four roles of SIBs.* This is necessary, because standard economic indicators that are used in market failure cost–benefit analysis fail to capture precisely the aspects that make the market failure perspective limited.
- (2) *Cross-comparison of different SIBs and their model of operation.* This could help to identify the kinds of structures that may increase the efficiency and effectiveness of SIBs.
- (3) *In-depth case studies of a single SIB or a single SIB program,* particularly those that are most successful (generate positive returns) and mission-oriented, respectively. This, too, would help to identify structures, tools and policies that increase the effectiveness of SIBs.

SIBs are not uniform in their size, scope and structure; they differ along many dimensions such as: funding source and cost; ownership type; direct or indirect funding (via private agents); activities, program, portfolio of investments, and financing tools; regulatory environment and specific bylaws; priorities; performance; among other aspects. Thus, future research could seek to address more specific questions such as:

- Is the investment in low-risk, big players always warranted? When should SIBs pull out?
- Does it matter and what are the implications to be funded by the treasury/budget, central bank or the market?
- What are the implications of directly providing finance and of operating through private agents? What are the upsides and downsides?
- How to appraise for the uncertainty of technological projects? How to structure portfolios of investments? And when to discard failed cases and what to do with them?

- Related to the previous question, what is the economically and socially acceptable number of failures that SIBs might afford to bear?¹⁷ Should SIBs engage in “martingale”-like strategy, whereby they increase their investments (and potential pay-off) in order to cover for past failures?

We believe our typology opens up a fruitful research agenda that could improve our understanding of the degree to which the activities of states investment banks are creating new technological landscapes and economic opportunities – *making things happen that otherwise would not*: SIBs shaping and creating markets not only fixing them.

Acknowledgements

The authors would like to thank Prof. Rainer Kattel, Prof. Lavinia Barros de Castro, two anonymous reviewers from the SPRU Working paper series (on a previous version of this paper), and the two anonymous reviewers of the *Journal of Economic Policy Reform* for their invaluable comments (usual disclaimer apply).

Disclosure statement

No potential conflict of interest was reported by the authors.

Funding

The research for this paper has been supported by grants from the Ford Foundation [grant number 1125-1696-0]; European Union’s Horizon 2020 Framework for Research and Innovation - Project ISIGrowth [grant number 649186]; the Institute for New Economic Thinking Foundation [grant number 1125-1696-0].

Notes

1. There are different terms that are used to refer to these institutions such as: “development bank”, “promotional bank”, “development finance institutions”, “international financial institution” and “SIB”. They are used in reference to institutions of similar but not identical characteristics, including national (e.g. Germany’s KfW or Brazil’s BNDES) and regional development banks (e.g. the European Investment Bank or the Asian Development Bank). In this paper, we adopt the term “SIB” to refer to all these institutions, whose empirical differences are not tackled due to space constrains. The study of whether and how such differences matter is a fruitful agenda of research, which we will elaborate in the concluding section.
2. We thank one of the reviewers for raising this insight.
3. <http://www.ltic.org/Japan-Bank-for-International.html>; accessed 16 June 2014. In 1999, the Export–Import Bank of Japan (JEXIM) and Japan’s Overseas Economic Cooperation Fund were merged into the Japan Bank for International Cooperation (JBIC).
4. <http://www.dbj.jp/en/co/info/history/index.html>; accessed 16 June 2014.
5. The Brazilian development bank was founded as *BNDE*; it was not until the 1980s that the name was changed to incorporate an explicit “social” focus.
6. <https://www.kdb.co.kr/ih/wcms.do>; accessed 16 June, 2014.
7. http://www.bdc.ca/EN/about/overview/history/Pages/new_mandate.aspx and http://www.bdc.ca/EN/about/overview/history/Pages/untill_today.aspx; accessed 16 June, 2014.
8. http://www.koreaexim.go.kr/en/exim/glance/manage_01.jsp; accessed 16 June, 2014.
9. Due to space limitations, we do not present in this paper the contemporary evidence that SIBs continue to play these four roles. In a preliminary version (Mazzucato and Penna 2014), we collect and present such evidence; in Mazzucato and Penna (2015), we present more detailed evidence of the challenge-led role for two of the most active SIBs in the world: Germany’s KfW and Brazil’s BNDES.

10. Some definitions of the FFT posit that the two crucial assumptions are that markets are complete and agents are price-takers, and that a Pareto equilibrium also requires the “weak” assumption of local nonsatiation of preferences. Ledyard (2008) argues that the existence of equilibrium situations was also a precondition for a Pareto-efficient allocation of resources, even though most violations of the assumption that an equilibrium exist lead to non-competitive situations.
11. There are also situations of “constrained Pareto efficiency”, when public policies are unable to create a more efficient outcome than the one resulting from competitive market, because the public authority faces the same (informational or institutional constraints) as private agents. Such a situation happens, for instance, when a public policy aims to address the lack of markets, but it unintentionally leads to non-competitive agent behaviour. Such issues arising from constrained Pareto efficiency are not the same as when the policy results in other types of government failures, usually attached to the roles of SIBs (see Mazzucato and Penna 2014).
12. We thank Lavinia Barros de Castro for stimulating us to expand on the market failure rationales for the support of exporting activities.
13. R&D projects may also be underfunded because the knowledge they generate is a public good. Therefore, R&D projects suffer with market failures both at the micro and macro levels.
14. Lall (2002, 103) defined social capital as “the ability of individuals in a group to form relationships of trust, cooperation and common purpose”. The state may promote social capital by bringing together different stakeholders of the capital development process and coordinating them through the establishment of a shared industrial strategy plan, which are often funded by SIBs.
15. This is not to say that private banks do not have a place to play – the opposite is true. But for private finance to achieve a productive, non-speculative role, appropriate regulations (including segmentation of activities) need to be in place, such as happened during the post-World War II “golden age”. Indeed, public banking and regulated private finance are the two sides of Minsky’s policy recommendation for a well-functioning financial system.
16. In Mazzucato and Penna (2014), we discussed both the tools that are used to assess and evaluate SIB investments from a market failure theory perspective, and the main criticisms attached to SIBs based on notions of “government failures”. Despite their importance, we did not include these discussions in this paper due to space constraints.
17. We thank one of the anonymous referees for raising this important question.

References

- Abramovitz, M. 1986. “Catching Up, Forging Ahead, and Falling Behind.” *The Journal of Economic History* 46: 385–406.
- Adams, G., and C. Williams. 2010. *Buying National Security: How America Plans and Pays for Its Global Role and Safety at Home*. New York: Routledge.
- De Aghion, B. A. 1999. “Development Banking.” *Journal of Development Economics* 58: 83–100.
- Amsden, A. H. 2001. *The Rise of “The Rest”: Challenges to the West from Late-industrializing Economies*. Oxford: Oxford University Press.
- Arrow, K. 1951. “An Extension of the Basic Theorems of Classical Welfare Economics.” In *Second Berkeley Symposium on Mathematical Statistics and Probability*, edited by J. Neyman, 507–532. Berkeley, CA: University of California Press.
- Arrow, K. J., and R. C. Lind. 1970. “Uncertainty and the Evaluation of Public Investment Decisions.” *The American Economic Review* 60: 364–378.
- Block, F. L., and Keller, M. R. 2011. *State of Innovation: The U.S. Government’s Role in Technology Development*. Boulder, CO: Paradigm.
- Bloom, N., and J. Van Reenen. 2007. “Measuring and Explaining Management Practices Across Firms and Countries.” *The Quarterly Journal of Economics* 122: 1351–1408.
- Branco, C. E. C. 1994. “Apoio às Pequenas e Médias Empresas de Base Tecnológica: A Experiência do Contec [Support to Small and Medium Sized Technology-Based Companies: The Contec Experience].” *Revista do BNDES* 1: 129–142.
- Buchanan, J. M. 2003. “Public Choice: The Origins and Development of a Research Program.” *Champions of Freedom* 31: 13–32.

- Climate Policy Initiative. 2013. "The Global Landscape of Climate Finance 2013." In *CPI Report*, edited by C. P. Initiative. Accessed September 3, 2013. <http://climatepolicyinitiative.org/wp-content/uploads/2013/10/The-Global-Landscape-of-Climate-Finance-2013.pdf>
- Coase, R. H. 1960. "The Problem of Social Cost." *Journal of Law & Economics* 3: 1–44.
- Debreu, G. 1959. *Theory of Value: An Axiomatic Analysis of Economic Equilibrium*. New York: Wiley.
- Dosi, G. 1982. "Technological Paradigms and Technological Trajectories: A Suggested Interpretation of the Determinants and Directions of Technical Change." *Research Policy* 11: 147–162.
- Dosi, G., and R. R. Nelson. 1994. "An Introduction to Evolutionary Theories in Economics." *Journal of Evolutionary Economics* 4: 153–172.
- Edquist, C., and J. M. Zabala-Iturriagoitia. 2012. "Public Procurement for Innovation as mission-oriented innovation policy." *Research Policy* 41: 1757–1769.
- Etzkowitz, H., and M. Ranga. 2009. "A Trans-Keynesian Vision of Innovation for the Contemporary Economic Crisis: 'Picking Winners' Revisited." *Science and Public Policy* 36: 799–808.
- Fagerberg, J., D. C. Mowery, and R. R. Nelson. 2005. *The Oxford Handbook of Innovation*. Oxford: Oxford University Press.
- Fergusson, D. 1948. "The Industrial Development Bank of Canada." *Journal of Business of the University of Chicago* 21: 214–229.
- Foray, D., D. Mowery, and R. R. Nelson. 2012. "Public R&D and Social Challenges: What Lessons from Mission R&D Programs?" *Research Policy* 41: 1697–1702.
- Freeman, C. 1996. "The Greening of Technology and Models of Innovation." *Technological Forecasting & Social Change* 53: 27–39.
- Fuchs, E. R. 2010. "Rethinking the Role of the State in Technology Development: DARPA and the Case for Embedded Network Governance." *Research Policy* 39: 1133–1147.
- George, G., and G. N. Prabhu. 2003. "Developmental Financial Institutions as Technology Policy Instruments: Implications for Innovation and Entrepreneurship in Emerging Economies." *Research Policy* 32: 89–108.
- Griffith-Jones, S., and J. Tyson. 2013. "The European Investment Bank: Lessons for Developing Countries." WIDER Working Paper.
- Gutierrez, E., H. P. Rudolph, T. Homa, and E. Blanco Benoit. 2011. "Development Banks: Role and Mechanisms to Increase Their Efficiency." World Bank Policy Research Working Paper.
- Haltiwanger, J., R. S. Jarmin, and J. Miranda. 2013. "Who Creates Jobs? Small versus Large versus Young." *Review of Economics and Statistics* 95: 347–361.
- Hirschman, A. O. 1958. *The Strategy of Economic Development*. New Haven, CT: Yale University Press.
- Hochstetler, K., and A. P. Montero. 2013. "The Renewed Developmental State: The National Development Bank and the Brazil Model." *Journal of Development Studies* 49: 1484–1499.
- Keynes, J. M. 1926. *The End of Laissez-Faire*. London: Prometheus Books.
- Keynes, J. M. 1980. "Activities 1940–46. Shaping the Post-war World: Employment and Commodities." In *Collected Works*, edited by D. Moggridge, Vol. XXVII. London: MacMillan.
- Keynes, J. M. (1936) 2006. *General Theory of Employment, Interest and Money*. New Delhi: Atlanti.
- KfW. 2009. *KfW Annual Report 2008*. Frankfurt am Main: KfW Group.
- Lall, S. 2002. "Social Capital and Industrial Transformation." In *Capacity for Development: New Solutions to Old Problems*, edited by S. Fukuda-Parr, C. Lopes, and K. Malik, 101–119. New York: UNDP.
- Ledyard, J. O. 2008. "Market Failure." In *The New Palgrave Dictionary of Economics*, edited by Steven N. Durlauf and Lawrence E. Blume, 300–303. Basingstoke: Palgrave Macmillan.
- Levy-Yeyati, E., A. Micco, and U. Panizza. 2004. "Should the Government be in the Banking Business? The Role of State-owned and Development Banks." IDB Working Paper.
- Lisboa, M. D. B., and Z. A. Latif. 2013. "Democracy and Growth in Brazil." Insper Working Paper, 311/2013.
- Luna-Martinez, D., and C. L. Vicente. 2012. "Global Survey of Development Banks." World Bank Policy Research Working Paper.
- Mankiw, N. G., and D. Romer. 1991. *New Keynesian Economics*. Cambridge, MA: MIT Press.
- Mathews, J. A. 2006. "Catch-up Strategies and the Latecomer Effect in Industrial Development." *New Political Economy* 11: 313–335.

- Mazzucato, M. 2013a. *The Entrepreneurial State: Debunking the Public vs. Private Myth in Risk and Innovation*. London: Anthem Press.
- Mazzucato, M. 2013b. "Financing Innovation: Creative Destruction vs. Destructive Creation." *Industrial and Corporate Change* 22: 851–867.
- Mazzucato, M., and Penna, C. C. R. 2014. "Beyond Market Failures: State Investment Banks and the 'Mission-oriented' Finance for Innovation." SPRU Working Paper Series, 2014–21.
- Mazzucato, M., and C. C. R. Penna. 2015. "The Rise of Mission-oriented State Investment Banks: The Cases of Germany's KfW and Brazil's BNDES." SPRU Working Paper Series, 2015–26.
- Minsky, H. P. 1992. "The Capital Development of the Economy and the Structure of Financial Institutions." Levy Institute Working Paper Series, 72.
- Minsky, H. P. 1993. "Community Development Banks: An Idea in Search of Substance". *Hyman P. Minsky Archive*, Paper 278.
- Minsky, H. P., and Whalen, C. 1996. "Economic Insecurity and the Institutional Prerequisites for Successful Capitalism." Levy Institute Working Paper Series, 165.
- Mowery, D. C. 2012. "Defense-related R&D as a Model for "Grand Challenges" Technology Policies." *Research Policy* 41: 1703–1715.
- Mowery, D. C., R. R. Nelson, and B. R. Martin. 2010. "Technology Policy and Global Warming: Why New Policy Models are Needed (Or Why Putting New Wine in Old Bottles Won't Work)." *Research Policy* 39: 1011–1023.
- Mussler, H. 2013. "Germany's Vampire Squid." *Financial World* February: 28–29.
- Murray, F., S. Stern, G. Campbell, and A. MacCormack. 2012. "Grand Innovation Prizes: A theoretical, normative, and empirical evaluation." *Research Policy* 41: 1779–1792.
- Nelson, R. R., and S. G. Winter. 1982. *An Evolutionary Theory of Economic Change*. Cambridge, MA: Belknap Press.
- Nightingale, P., and A. Coad. 2014. "Muppets and Gazelles: Political and Methodological Biases in Entrepreneurship Research." *Industrial and Corporate Change* 23: 113–143.
- Nurkse, R. 1966. *Problems of Capital Formation in Underdeveloped Countries*. New York: Oxford University Press.
- O'Riain, S. 2004. *The Politics of High Tech Growth: Developmental Network States in the Global Economy*. Cambridge: Cambridge University Press.
- O'sullivan, M. 2004. "Finance and Innovation." In *The Oxford Handbook of Innovation*, edited by J. Fagerberg, D. C. Mowery, and R. R. Nelson, 240–265. New York: Oxford University Press.
- Papadimitriou, D. B., and L. R. Wray. 1998. "The Economic Contributions of Hyman Minsky: Varieties of Capitalism and Institutional Reform." *Review of Political Economy* 10: 199–225.
- Pearson, S. 2012. "A Bank Too Big to Be Beautiful." *Financial Times*, September 24. Accessed September 20, 2013. <http://www.ft.com/cms/s/0/983f1bca-0234-11e2-b41f-00144feabdc0.html>
- Perez, C. 2002. *Technological Revolutions and Financial Capital: The Dynamics of Bubbles and Golden Ages*. Cheltenham: Edgar Elgar.
- Pinto, L. F. G. 1997. "Capital de Risco: Uma Alternativa de Financiamento às Pequenas e Médias Empresas de Base Tecnológica – O Caso do Contec [Venture Capital: Funding Alternative for Small and Medium Sized Technology-Based Companies - The Case of Contec]." *Revista do BNDES*, 7.
- Polanyi, K. (1944) 2001. *The Great Transformation: The Political and Economic Origins of Our Time*. Boston, MA: Beacon Press.
- Prebisch, R. 1950. "Economic Development of Latin America and its Principal Problems". *Economic Bulletin for Latin America* 7: 1–12.
- Reinert, E. S. 1999. "The Role of the State in Economic Growth." *Journal of Economic Studies* 26: 268–326.
- Rodrik, D. 2004. "Industrial Policy for the Twenty-First Century." *John F. Kennedy School of Government Working Paper Series*, rwp04-047.
- Sampat, B. N. 2012. "Mission-oriented biomedical research at the NIH." *Research Policy* 41: 1729–1741.
- Sanderson, H., and M. Forsythe. 2013. *China's Superbank: Debt, Oil and Influence – How China Development Bank Is Rewriting the Rules of Finance*. Singapore: Wiley.

- Schapiro, M. G. 2012. "Rediscovering the Developmental Path? Development Bank, Law, and Innovation Financing in the Brazilian Economy." SSRN Working Paper, January 17. Accessed April 13, 2013. http://papers.ssrn.com/sol3/papers.cfm?abstract_id=1986915
- Schröder, M., P. Ekins, A. Power, M. Zulauf, and R. Lowe. 2011. *The KfW Experience in the Reduction of Energy Use in and Co₂ Emissions from Buildings: Operation, Impacts and Lessons for the UK*. London: UCL Energy Institute, University College London and LSE Housing and Communities, London School of Economics.
- Schumpeter, J. A. (1912) 1934. *The Theory of Economic Development: An Inquiry into Profits, Capital, Credit, Interest, and the Business Cycle*. Cambridge, MA: Harvard University Press.
- Schumpeter, J. A. 1939. *Business Cycles; A Theoretical, Historical, and Statistical Analysis of the Capitalist Process*. New York: McGraw-Hill.
- Schumpeter, J. A. (1912) 2002. "Seventh Chapter of the Theory of Economic Development." *Industry and Innovation* 9: 93–145.
- Singer, H. W. 1950. "Comments to the Terms of Trade and Economic Development." *Review of Economics and Statistics* 40: 84–89.
- Soete, L., and A. Arundel. 1993. "An Integrated Approach to European Innovation and Technology Diffusion Policy: A Maastricht Memorandum." *Commission of the European Communities, SPRINT Programme*, Luxembourg.
- Stern, N. N. H. 2007. *The Economics of Climate Change (Stern Review)*. Cambridge: Cambridge University Press.
- Stiglitz, J. 1974. "Growth with Exhaustible Natural Resources: The Competitive Economy." *The Review of Economic Studies* 41: 139–152.
- Stiglitz, J. 1991. "The Invisible Hand and Modern Welfare Economics." NBER Working Paper, 3641.
- Stiglitz, J., and A. Weiss. 1981. "Credit Rationing in Markets with Imperfect Information." *American Economic Review* 3: 393–410.
- Tcherneva, P. R. 2008. "Keynes's Approach to Full Employment: Aggregate or Targeted Demand?" The Levy Economics Institute Working Paper Collection, 542.
- Torres Filho, E. T., and F. N. D. Costa 2012. "BNDES e o financiamento do desenvolvimento [BNDES and the financing of development]." *Economia e Sociedade* 21: 975–1009.
- Tullock, G., A. Seldon, G. L. Brady, and G. Tullock. 2002. *Government Failure: A Primer in Public Choice*. Washington, DC: Cato Institute.
- Veugelers, R. 2012. "Which policy instruments to induce clean innovating?" *Research Policy* 41: 1770–1778.
- Wade, R. 1990. *Governing the Market: Economic Theory and the Role of Government in East Asian Industrialization*. Princeton, NJ: Princeton University Press.
- World Bank. 2013. *History* [Online]. Accessed February 2, 2013. <http://go.worldbank.org/65Y36GNQB0>
- Wray, L. R. 2012. "The Great Crash of 2007 Viewed through the Perspective of Veblen's Theory of the Business Enterprise, Keynes's Monetary Theory of Production and Minsky's Financial Instability Hypothesis." In *Thorstein Veblen: Economics for an Age of Crises*, edited by E. S. Reinert and F. L. Viano, 303–316. London: Anthem Press.
- Wright, B. D. 2012. "Grand Missions of Agricultural Innovation." *Research Policy* 41: 1716–1728.