
Financing innovation: creative destruction vs. destructive creation

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Although the 2007 financial crisis, and the ensuing world-wide recession, has caused policy makers to want to ‘re-stabilize’ the financial sector as well as ‘re-balance’ economies away from finance toward the ‘real’ economy, this article claims that to bring finance back to serve the real economy, it is fundamental to (a) also de-financialize companies in the real economy, and (b) think clearly how to structure finance so that it can provide the long-term committed patient capital required by innovation. Without this, the risk is that current policy produces a healthy financial sector (bailed out, ring-fenced, and re-structured) in a deeply sick economy, which continues to reward value extraction over value creation activities.

1. Finance and innovation: a *dynamic* relationship

Understanding the relationship between finance, innovation, and growth must begin with understanding the deeply ‘uncertain’ character of innovation. Investment in innovation is a bet on the future, and most attempts fail. Contrary to playing lottery or roulette, where the probabilities of winning are known in advance, innovation embodies deep ‘Knightian uncertainty’, which cannot be calculated via probabilities, whether objective or subjective (Knight, 1921). Technological change produces uncertainty for all the economic actors involved, those investing in it and those experiencing its effects (such as competing firms and workers employed). However, this does not mean that it is a result of luck: it is long-term strategic commitments that determine its success. And such commitment requires a specific type of finance (whether internal or external). It is thus paradoxical that the field of economics, orthodox as well as non-orthodox approaches, has not yet produced a thorough understanding of the links between invention, innovation, diffusion, and the

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financial analysis of risk and uncertainty, and the type of financial structures that are key for the innovative enterprise to succeed.

It was Joseph Schumpeter who first drew a strong connection between the innovation performance of an economy and the functioning of its credit and capital markets (Schumpeter, 1912). His discussion of creative destruction is rightly regarded as a major contribution to the economic understanding of how company formation contributes to economic adaptation and growth. And how investment in innovation is financed was one of the main axes with which he distinguished different forms of capitalism (Schumpeter, 1942). He claimed that in a capitalist society, ‘credit is essentially the creation of purchasing power for the purpose of transferring it to the entrepreneur’ (Schumpeter, 1912, p. 107). Thus, innovation requires a credit system, and the credit system is a result of this necessity. The banker is the ‘capitalist par excellence’, the ‘ephor’ of the capitalist system, as he/she produces ‘the commodity “purchasing power”’ that makes it possible to carry out the new combinations associated with innovation (Schumpeter, 1912, p. 74).

Applied to the analysis of the contemporary economy, Schumpeter’s theme of finance and innovation translates into a series of important issues concerning the relative role of established and start-up companies in the innovation process, the complementarities between them, and the differential access they have to capital markets to fund business experimentation. As traditional profit maximizing banks fear the kind of fundamental uncertainty underlying innovation, innovation has often had to be funded by alternative sources, such as venture capital, business angels or public funding bodies, including state investment banks. Given the varieties of capitalism (Hall and Soskice, 2001), it is also true that in countries with more of a ‘stakeholder’-type capitalism, such as Germany and Japan, banks have been more willing to be ‘patient’ players in the innovation game, than in countries with a ‘shareholder’ type of capitalism, driven by quick returns and speculation (Tylecote and Visintin, 2008).

The relationship between finance and innovation needs to be studied in a dynamic context able to deal with heterogeneity, change, and the kind of disequilibrium processes that Schumpeter highlighted were at the center of capitalist competition. As emphasized in the evolutionary tradition in economics, it is forces of business experimentation and mechanisms of competitive selection (‘winnowing’ in on the variety which experimentation produces), which economic theory must incorporate to provide a dynamic, rather than a static, understanding of the capitalist economy (Dosi and Nelson, 1994; Metcalfe, 1994; Nelson and Winter, 1982). Yet, ‘selection’ does not mean ‘survival of the fittest’. Which firms grow and survive is the result of selection processes in both product markets and financial markets, often conflicting (Geroski and Mazzucato, 2002), and each characterized by path-dependent processes. Indeed, the financial structure of the economy (e.g. credit based versus debt based) will determine the speed and the pressures felt in selection processes,

and affect different opportunities for learning and acquiring capabilities (Dosi, 1990).

Schumpeter's distinction between innovation dynamics in small entrepreneurial firms (a focus of his early work, 1912, often referred to as Schumpeter Mark 1) from that in large incumbent firms (a focus of his later work, 1942, referred to as Schumpeter Mark 2) raises the question, what kind of finance is required by what kind of firms, and as those firms change over time (e.g. over the industry life-cycle, Klepper, 1997), how their need for finance changes. Small innovative firms, focused on 'exploration' activities, have had to depend more on equity markets to fund R&D (Brown *et al.*, 2009)—with the predominant mode of venture capital that emerged in the 1970s and 1980s being private equity (limited partnerships) rather than public equity (Gompers and Lerner, 2004). Instead large firms, focused more on 'exploitation' activities, have been able to rely on retained earnings, debt, as well as on large institutional investors.¹

Firms, even of the same size, have different cost structures and operate in different types of markets and through different types of competition—these differences affect their needs for finance. O'Sullivan (2005) points to how new entrants who compete directly with incumbents (e.g. in the disc drive industry) will need a different type of financing from new entrants who engage in alliances, like licensing or joint ventures, with incumbents (e.g. in the biotechnology industry). And science-based sectors (Pavitt, 1984), in which firms depend largely on publicly funded research (e.g. pharmaceuticals), will again require a different type of finance.

Financial dynamics differ not only between sectors, and between phases in an industry's life-cycle, but also over longer phases of technological revolutions. Perez's (2002) work provides a dynamic historical view on the changing role of finance over the course of technological trajectories, emphasizing the need for 'courageous and bold' finance to kick-start periods of radical change when 'production capital' is still too wed to the status quo. She argues that financial capital has a fundamental role in the articulation and propagation of technological revolutions principally because the irruption of technological revolutions finds a conservative environment. She builds on the notion that technical change occurs by successive revolutions with several decades between them, re-affirming Schumpeter's view of the clustering of entrepreneurship in specific periods. The bunching of intense radical change also brings forth clusters of bold—sometimes reckless—financiers in support of the production entrepreneurs. Major financial bubbles are thus interpreted by Perez (2002) as massive processes of credit creation to install each technological revolution. And it is

¹As discussed further later in the text, a key problem since the 1970s is the way that large companies have become increasingly 'financialized' (Dore, 2009), reinvesting less of their earnings on productive investment and innovation and more on boosting their stock prices, through practices like share buybacks. Lazonick and O'Sullivan (2000) call this a move from 'retain and reinvest' to 'downsize and distribute'.

important to remember that innovation happens in clusters (and waves); therefore, models that assume the financial and innovation variables can be modeled as a Gaussian process (an identically and independently distributed random variable) will fail to capture the true relationship.²

2. Do financial markets help or hurt innovation?

What has, however, been relatively ignored in the literature on finance and innovation is the feedback relationship between finance, investment, and innovation: if different types of firms (Schumpeter Mark 1 versus Mark 2) require different types of finance, what do we know about the way in which different types of finance (venture capital, stock market funding, funding from public agencies or state investment banks) feedback into the investment and innovation process itself, affecting both the rate and direction of innovation pursued by firms? The answer is: not much.

This Special Issue of *Industrial and Corporate Change* is dedicated to thinking about these relationships, at the firm and sectoral level, revealing how different types of finance (venture capital, the stock market, large institutional investors, and public funding agencies) affect the type of innovation that companies are willing and/or able to pursue. A key concern of the issue is how to reform financial markets so that they reward rather than penalize those firms pursuing investments needed for innovation to occur. Or using language from Minsky (1992), the problem is how to reform the financial system so that it nurtures the ‘capital development’ of the economy, and in so doing renders capitalism not only more dynamic but also more stable.

In an evolutionary setting, this is of course fundamental as ‘selection’ processes in financial markets may differ from those in product markets with the former affecting not only the degree of short/long termism that firms can pursue but also the type of investments and innovation they later pursue (Dosi, 1990). Indeed, precisely because innovation is a complex process frequently ending in failure, the stock market often penalizes firms after they announce the start of a challenging R&D project (Mazzucato and Tancioni, 2012). When in 2006, Microsoft announced that it would embark on a challenging and costly research project to compete with Yahoo’s and Google’s search engine, the next day its stock price fell by >11%, reducing the company’s market capitalization by close to \$32 billion (Lazonick, 2013, p. 894). Although Microsoft is big enough to continue with its plans, smaller

²This of course is a lesson that has been learned after the financial crisis, with the advent of large ‘black swan events’ (Taleb, 2010), but one that researchers in the Schumpeterian-evolutionary tradition have been pushing for a much longer time (for a review of why innovation should be understood as a non-Gaussian process, see Dosi, 2005).

firms might have to abandon their commitment to innovation in light of such a reaction.

In industries characterized by the venture capital model of finance, such as biotechnology, different authors have pointed to the difficulty of this type of funding to provide the kind of patient long-term committed finance that is needed by uncertain innovation processes with long time horizons. In arguing that ‘Science is not a Business’, Pisano (2006) argues that the VC model is problematic for science-based sectors characterized by a complex and interdisciplinary knowledge base. Lazonick and Tulum (2011) argue similarly that the prevalence of so many ‘product-less’ public companies in biotech (PLIPOS: product-less IPOs) is a result of a funding structure focused on early exits—unable to nurture and support the underlying complex and uncertain knowledge base. This problem is being felt strongly today in the emerging clean-technology sector where venture capital is either absent or producing the quick in/out funding dynamic that results in bankruptcies such as that of Solyndra in 2012 (Hopkins and Lazonick, 2012). Similarly, Mirowski (2011) warns of the dysfunctional result that can arise when science is funded by venture capital focused on an early ‘exit’:

‘... commercialized scientific research in the absence of any product lines, heavily dependent upon early-stage venture capital and a later IPO launch, deriving from or displacing academic research, with mergers and acquisitions as the most common terminal state, pitched to facilitate the outsourcing of R&D from large corporations bent upon shedding their previous in-house capacity.’ (Mirowski, 2011, p. 208)

The degree to which companies face shareholder pressure can limit their ability to invest in areas of long-run innovation. This is related to how companies are structured, i.e. their corporate governance, which will embody different degrees of willingness of the company to take risks, and to invest in the type of risks that innovation entails. The implications for innovation of the stakeholder model of corporate governance and the shareholder model of corporate governance (Jensen, 1986) have been studied both across countries (e.g. Japan versus the United States) and across different sectors (Tylecote and Visintin, 2008). In general, these studies show that the short-termism of shareholder capitalism creates negative incentives for companies to invest in (uncertain) innovation (Dore, 2008). Lazonick and O’Sullivan (2000) argue that ‘maximizing shareholder value’ is a managerial ideology that in the United States has enabled top executives to get extremely rich. They argue specifically that the problem of value extraction is not primarily, or even significantly, the result of shareholder pressure. Financialized companies, able to ‘manipulate’ their stock prices, have resulted in an increasing amount of companies spending a large percentage of their sales on buying back their stock and boost the value of stock options, closely linked to executive pay. Companies like CISCO and Microsoft have reacted to the pressures from large shareholders (and senior executives), such as the example above depicted for Microsoft, by escalating their use of buybacks, rather than in

increasing their commitment to renewed innovation, hurting both companies' ability to remain on the leading edge today. Indeed, during the past decade, Fortune 500 companies have spent \$3 trillion on share buybacks. And as can be seen in Fig. 1, such spending has occurred at the expense of innovation (Lazonick, 2007; FINNOV, 2010).

Although the 'short-termism' problem is a real one (Kay, 2012), it is often discussed without specifying the forces that lead to it. It is not 'markets' that impose short-termism, but powerful players in the market, such as senior executives (whose remuneration is based on stock options, and, hence, on boosted stock prices). Ignoring these market 'power' relationships, and not distinguishing the 'market' from the concrete ways in which market organizations (firms) are 'governed', risks missing the key factor which is undermining long-run competitiveness (Lazonick and O'Sullivan, 2000).

Furthermore, as emphasized by Stirling (2009), innovation has not only a rate but also a direction. The way in which finance affects this direction is not well understood. Abraham (2011) has looked at how the health and life science industry has become too 'pharmaceuticalized' with firms focusing almost solely on drugs, which are easier to understand (less complex) and more profitable, than other areas like diagnostics, surgical treatments, and life-style remedies. How the financial structure of an industry affects this directional bias, is a key area for future research. From a policy-making point of view, it is crucial to consider how the 'eco-system' of financial institutions can 'broaden out' the innovation landscape rather than close it down, as is currently the case in many sectors.

Indeed, one of the roles of successful public funding agencies within these eco-systems has been to broaden-out innovation through 'mission-oriented' investments (Mowery, 2010)—whether this was putting a 'man on the moon' in the past or investing in renewable energy technologies in the future. Mowery (2010) has emphasized how such mission-oriented investments and funding structures cannot be understood through the traditional 'market failure' understanding of public policy. As Keynes (1926) argued in *The End of Laissez Faire*, policy is not about '*...doing things just a little bit better or a little bit worse, but doing what is not being done at all*'. And ironically, one of the governments that has had the most 'visible hand' in innovation policy, investing actively in key areas, providing both research funding as well as early stage capital financing, has been the US government (Block and Keller, 2011). Every radical technology that makes Apple's iPhone a 'smart' phone was funded by the US government: the Internet, GPS, touchscreen display, the voice-activated artificial intelligence personal assistant 'SIRI', among other technologies (Mazzucato, 2013). And across the world today, there is evidence that some of the most radical green investments are being made by public agencies, from ARPA-E in the United States, to the China Development Bank (CDB). Indeed, the CDB, along with other investment banks like BNDES in Brazil or the European Investment Bank (EIB), are providing not only important counter cyclical lending (increasing

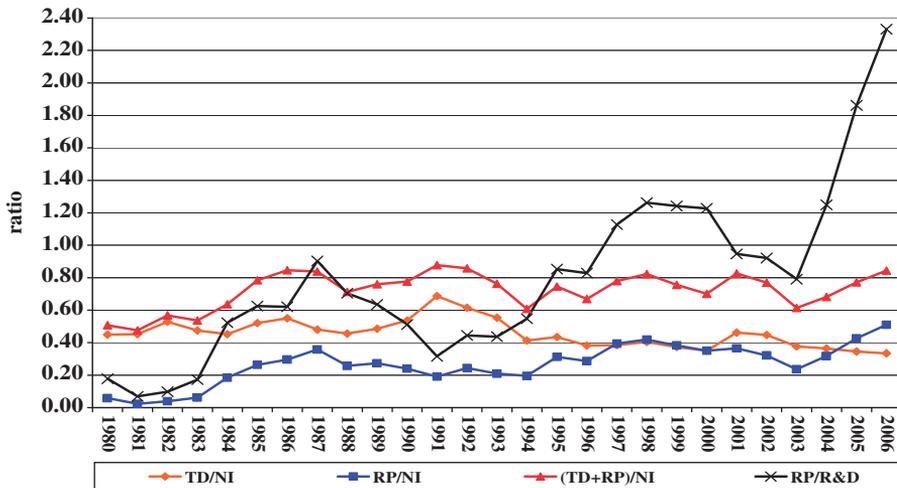


Figure 1 Repurchases (RP), dividends (TD), net income (NI), R&D 1980–2006 (293 corporations in the S&P500 in October 2007 in operation in 1980, *source*: Lazonick, 2007, p. 989).

disbursement rates after the crisis, whereas private banking decreased it), but also providing strategic direction to that lending, such as in the emerging clean tech sector (GWEC, 2012). Although such public funding often gets accused of potentially ‘crowding out’ private finance, and being too active in picking winners, the problem is that in a world in which private finance is pursuing short-term profits and focusing on value extraction activities, often it is only public finance that is able to provide the long-term patient capital that nurtures learning and innovation.

However, it is also true that precisely because publicly funded patient capital is so important, it is important to make sure that the direction of that funding be intensely and democratically debated. This is especially important in the development of today’s ‘green’ renewable energy sector, where public sector actors should be resisting the pressures by the big energy companies to continue within a fossil fuel trajectory. Instead, recent developments (mainly but not only in the United States), whereby the state has been the lead actor in promoting the shale gas (fossil fuel) revolution, go against this suggestion.

3. Creative Destruction versus Destructive Creation

How to structure finance so that it nurtures rather than hurts innovation is not a question that Schumpeter asked. This is not only because of the time in which he lived (a time in which ‘financialization’ was not as prevalent), but also because of his semi-romantic view of the banker as the ‘ephor’ of capitalism. This fetishization of

private finance's role is of course still prevalent today among many innovation scholars who romanticize the role of venture capital (Mazzucato, 2013).³

Much of the tension between the role of finance in nurturing or penalizing innovation has to do with its ability to facilitate the process of creating value in the economy, or its focus on simply extracting it. Yet the tension between value creation and value extraction, with respect to innovation, has been under-theorized. An exception is the work of Minsky, which extends Schumpeter's analysis of innovation to the financial sector itself (Minsky, 1990, 1993). Like any other firm, a bank continually seeks to reduce costs and increase revenues, with innovations helping to do both while also changing the structure of the financial system and, hence, the structure of the non-financial system whose behavior is heavily influenced by the structure of finance (Wray, 2010). Minsky's work provides a framework for understanding the changing role that finance plays in the real economy, from that of hedge, speculative, and Ponzi structures—lending first too much, which leads to a bubble, then too little, putting a break on the economy and transforming a financial crisis into a full-blown economic crisis. Minsky focused on the fact that as capitalism is a monetary economy, based on credit (which does more than just grease the wheels of commerce), the dynamics of credit and speculation need to be understood. And most of all, understanding how to reform finance so that it nurtures the capital structure of the economy is central for understanding how finance can nurture innovation.

The financial crisis exposed the inability of traditional finance models to understand the way that risk was being accumulated, yet hidden, in the economy through the splicing and dicing of risk by different types of 'financial innovations' (e.g. credit default swaps, derivatives), bringing new heights to the moral hazard problem. Yet, little attention has been given to the fact that innovation, hence the 'capital development of the economy,' requires a specific type of risk taking: Schumpeterian risk aimed at creative destruction, not destructive creation. Indeed, evidence suggests that banks are unable to differentiate these two types of risk. Bottazzi *et al.* (2011) find that the credit scores that banks give to companies underemphasize the real health of the companies, as proxied by their productivity. Figure 2 shows the worrying result whereby the probability of a firm receiving a 'bad' credit score is just as high for a highly productive company as it is for an unproductive company (value added is used as a proxy for productivity). The problem is that the risk profile of companies does not distinguish where that risk is coming from. Companies that spend more on R&D, for example, will inevitably have higher risk, as, as discussed earlier in the text, innovation is so deeply uncertain—most attempts at innovation fail. Yet banks today seem to not know how to differentiate the 'good' risk from the 'bad' risk that arises simply from weak economic performance or speculative activities and higher debt. When Wall Street was still run, before the 1970s revolution, through 'investment'

³For a fascinating discussion of how the fetishization of venture capital is related to the fetishization of the role of 'entrepreneurship' and SMEs, see Nightingale and Coad (2013).

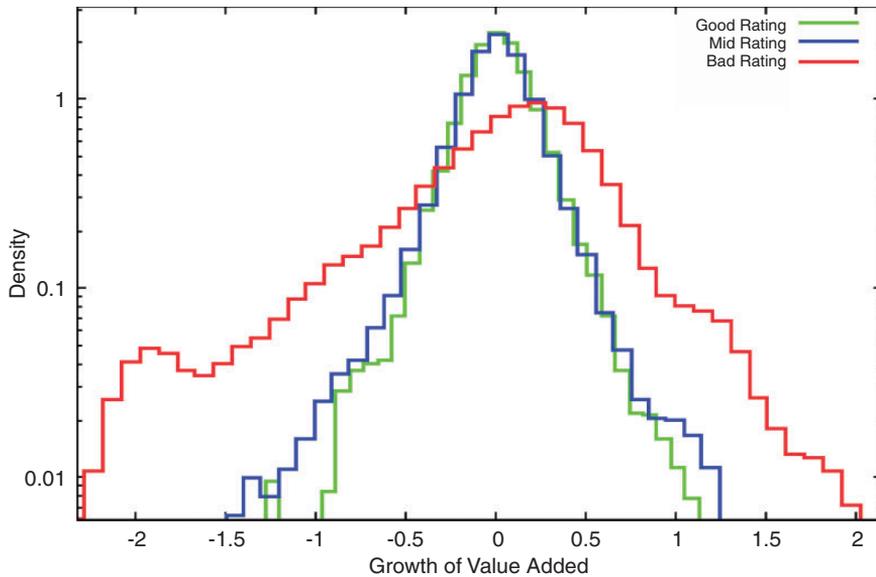


Figure 2 Credit scores and Productivity for Italian Manufacturing Firms 1998–2004 (source: Bottazzi *et al.* 2011 and FINNOV, 2010).

(via long-term bond issues) rather than trading, it was easier for investment banks to differentiate good risks from bad risks. It was the transformation of Wall Street finance from investing in innovation to profiting from speculation and manipulation (Lazonick, 2007) that is the source of this inability to distinguish between good and bad risk. Hence, a solution to the problem is much deeper than a technical fix to risk models.

It is thus not surprising that the credit crunch that followed the financial crisis has hurt innovative companies the most. Cosh *et al.* (2009) find that since 2007–2008, it has been the most innovative companies in the UK that have been hit the hardest by increases in interest rates. They speculate that this was due to their higher risk profile. An important implication is that rather than focusing on bank lending to SMEs, as current ‘banking reforms’ are suggesting (ICB 2011), it would be more useful to help banks develop new credit score mechanisms that better reflect the innovative potential of companies, of whatever size, so that innovation-related investments are rewarded (and funded) rather than penalized.

4. Bringing financial policy and industrial policy together

A key lesson is that financial reform and innovation policy must go hand in hand. Yet this is not happening. The reason it is not happening is that there is too much

emphasis on stabilizing the financial system, rather than transforming it into one that serves innovation and the needs of the capital development of the economy. Indeed, recent recommendations to ‘ring fence’ commercial banking from the perils of investment banking (ICB, 2011) do not adequately address the needs of small high-growth firms to receive proper investment (they will not be served well by commercial banks). Understanding what type of financial structure an economy needs to foster long-run innovation-led growth is a burning question that remains unanswered in the post-crisis reforms.

Figure 3 shows the way that the size of the financial sector grew exponentially in the decade before the crisis, as a percentage of value added (aggregate ‘real’ value added is approximately the entire economy minus agriculture and finance). The speed at which the financial sector grew was mainly because of profits of financial companies, i.e. their ability to reap a gain from value created elsewhere (such as innovation in new sectors), growing more quickly than those of non-financial ones. Indeed, the origins of the financial crisis and the massive and disproportionate growth of the financial sector began in the early-2000s when banks began increasingly to lend to other financial institutions, via whole-sale markets, to make loans not matched by deposits. They lent mainly to hedge funds, private equity, and subprime mortgages, as well as derivatives built on these, because the returns were higher than lending to industry or government. They magnified their return on equity by shrinking the equity, and multiplied their capital gains by speculatively investing borrowed funds, endangering their solvency as soon as asset prices fell. The risks were far higher, but severely underpriced. The result was that banks’ assets ballooned, but were increasingly fictitious. When asset prices fell, and bank equity was wiped out, they were so highly leveraged that it required only a 3% fall for the major bust to occur. But before that happened, bank assets and profits expanded relative to the rest of economy, increasing their value added contribution, as this is measured ‘indirectly’ by their interest margin.

This is the part of the story that most people understand, with growing attention being paid to rebalancing the economy away from finance, through policy instruments like industrial policy. However, while rebalancing the size of finance is part of the solution, it is also fundamental to ‘rebalance’ the effect that finance has had on how performance is measured, and achieved, in all sectors, including manufacturing. The problem has not been one of only short-termism, but also about the way in which activities focused on value extraction have been rewarded above activities focused on value creation, often leading also to value destruction.

This special issue contains articles that tackle different aspects of this problem. Focusing on firm and industry levels, the articles reveal the tension between the degree to which finance nurtures value creation, through its funding of innovation, and the degree to which it instead impedes this process by focusing solely on value extraction.

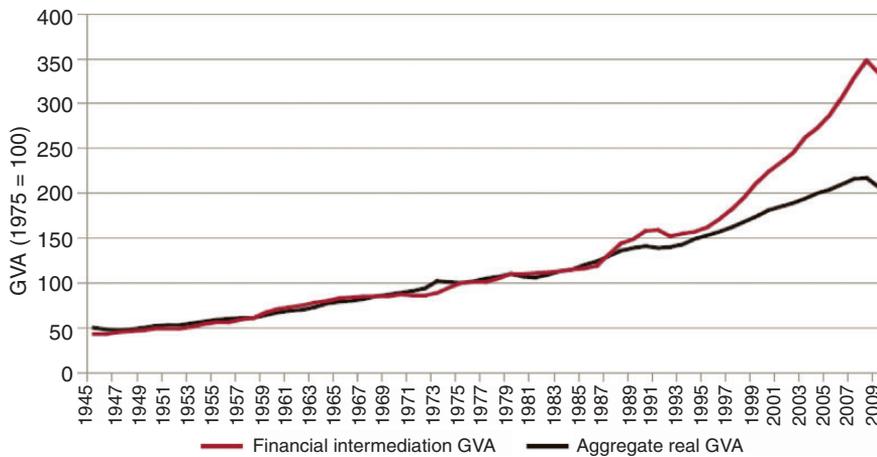


Figure 3 Financial intermediation and aggregate gross value added compared (source: Alessandri and Haldane 2009, Bank of England).

The special issue begins with an article that takes a different view on where the problem lies in the relationship between finance and innovation: demand not supply. Mina *et al.* (2013), ‘The Demand and Supply of External Finance for Innovative Firms’, complement previous studies where it is revealed that the problem in financing innovation comes more from the demand side than the supply side: there are not enough firms that want to grow (i.e. that the problem is not of ‘missing’ markets but of ‘thin’ markets, NESTA, 2009). Most firms that seek finance obtain it, and unfortunately it is those firms that are engaging with innovation that have the hardest time finding finance (because of their higher risk profile). One of the authors has already been instrumental in debunking the myth of the ‘under-financed’ SME, showing that in the UK, for example, SMEs actually receive more money than the police force: 8 billion/year (Hughes, 2008; Storey, 2006).

While the first article looks at finance for different types of firms, the next article looks at different types of finance within a particular sector, UK biotechnology. Hopkins *et al.* (2013), ‘Buying Big into Biotech: Scale, Financing and the Industrial Dynamics of UK Biotech: 1980-2009’, differentiate between VC funding and stock market funding. They look at which types of financing options have arisen and then closed down in the biotechnology industry, and find that the inability of the sector to achieve scale in the UK has caused stock market investment to fall, forcing the sector to be too dependent on VC, which, as discussed earlier in the text, is problematic in a science-based sector.

Revest and Sapio (2013), ‘Does the Alternative Investment Market (AIM) Nurture Firm Growth? A Comparison Between Listed and Private Companies’, focus on the ability of alternative financial instruments to promote innovation and growth. The

authors concentrate on different types of stock market ability to enable innovation and growth. They ask whether those types of markets that in theory are more geared for innovative companies because they have lower admission requirements (e.g. AIM in the UK) have indeed helped SMEs to grow or not. Interestingly, they find that although such markets nurture growth, they do not nurture productivity—which is not good for the long-run growth potential of firms.

The next two articles continue the study of the effect of the stock market on innovation—but in a less optimistic light. Montalban and Sakinc (2013), ‘Financialization and Productive Models in the Pharmaceutical Industry’, study the effect of financialization and competition on the ability of pharmaceutical and biotech companies to innovate. In particular, they focus on the effect that shareholder pressure has had on the decision of companies to pursue ‘blockbuster’ drugs. They find that the overreliance on the blockbuster model has caused the sector to become unsustainable now that the discovery of such drugs has fallen. A model in which more regular and systematic discoveries were emerging, rather than the reliance on the big earners, would have made the sector more sustainable and also more useful to society which of course requires new medicines for a wide range of diseases rather than only the big earning ones (obesity, diabetes, and so forth).

Brossard *et al.* (2013), ‘Ownership Structures and R&D in Europe: The Good Institutional Investors, the Bad and Ugly Impatient Shareholders’, also focus on shareholders, differentiating them by their ownership structure. The authors look at how different types of investors affect the innovation performance of firms. Using companies listed in the European R&D scoreboard, the authors look at different dimensions of ownership on R&D: the type of investor (institutional investors versus ‘strategic’ entities, ‘grey’ versus ‘independent’ investors), their past portfolio turnover (‘patient’ versus ‘impatient’ investors), their nationalities and their ownership concentration. The findings suggest that long-term institutional investors have a positive effect, whereas short-term impatient finance does not.

The article by Vitali *et al.* (2013), ‘The Impact of Classes of Innovators on Technology, Financial Fragility and Economic Growth’, is motivated by policy makers’ attention to producing growth that is not only ‘smart’ (innovation-led) but also ‘inclusive’, thus able to provide more jobs in the economy. The authors use an agent-based model to study how different types of innovators affect the macroeconomy in different ways. Focusing on single innovators, collaborative innovators, and imitators, the analysis looks at the impact of these three innovation categories on micro, meso, and macro aggregates. In a model that allows for ‘switching’ behavior between these categories of firms, they find that collaborative companies are those that have the highest positive impact on the economic system. When banks are introduced, the model finds a trade-off between short-term profit maximization and long-term efficiency, which prevents banks from fostering investment in R&D and technological progress.

Lazonick and Mazzucato (2013), ‘The Risk-Reward Nexus in the Innovation-Inequality Relationship Who Takes the Risks? Who Gets the Rewards?’, also begin with the EC 2020 strategy goal of smart and inclusive growth and argue that this requires understanding why it is that periods that were characterized by plenty of smart investments in innovation, such as the 1990s, were also periods in which inequality rose the fastest. While the ‘skill biased technical change’ approach to the question abstracts from the characteristics of innovation, the authors use three key characteristics of innovation (its uncertain, collective, and cumulative character) to study the relationship between innovation and inequality. They ask what types of economic actors (workers, taxpayers, and shareholders) make contributions of effort and money to the innovation process for the sake of future, inherently uncertain, returns. Are these the same types of economic actors who are able to appropriate returns from the innovation process over the course of the cumulative innovation cycle? That is, who takes the risks and who gets the rewards? The article claims there is a mismatch and that although risk is being increasingly socialized, profits are being privatized—hurting both inclusive growth as well as the future ability of the state to fund smart growth.

5. Conclusion

For financial markets to be reformed to support rather than hinder innovation, it is essential to consider the type of financial structure that supports the innovation process. A key lesson of the articles in this special issue is the way that regulation of financial markets must go hand in hand with policies that are aimed at innovation and industrial policy. The problem is not one of the big bad banks and dodgy financial innovations (e.g. hedge funds and credit default swaps) versus the (potentially) innovative ‘real economy’—restraining the former and liberating the latter. The key problem is how to de-financialize real economy companies, and to find ways that value creation activities (in both the financial sector and real economy) are rewarded over value extraction activities. This will entail both finding and supporting sources of finance that provide long-term committed patient capital, but also specific policy mechanisms that limit the power of large shareholders, which has allowed ‘trading’ to be rewarded over ‘investment’ and also caused innovation-led growth (a result of a collective process) to lead to a less collective, less equitable, highly unstable economic structure. And surely a financial transaction tax, as well as higher capital gains taxes (and lower taxes on labor), will help to rebalance incomes and incentives toward rewarding the arduous process of value creation rather than quick and easy trades.

The stakes are high, not only for the future capacity of nations to produce innovative firms and innovation-led growth. But more generally how to steer financial markets so that they better guide investments toward innovation and investment in

the capital development of the economy. A look at the Eurozone—currently in what seems a never-ending crisis—is useful. Indeed, Greece’s performance in the early 1990s during the beginning of the Euro was hardly worse than it is today. Yet, as what determined the ratings of its banks and sovereign bonds was not the real health of the country (e.g. its low productivity, or low investments in long-run growth measures), but short-term financial measures, Greece’s problems were not detected before it had absorbed unsustainable amounts of credit. The indicators of performance did not help to steer the country in the right direction, toward value creation. And the fact that it is today the short-sighted bond (financial) markets that are determining the recipe for the solution to the Eurozone crisis means that the proposed solutions for the weaker EZ countries (austerity and different types of structural reforms aimed at ‘liberalization’) are not allowing the much needed productive investments to happen: investment in skills, technology, and other determinants of productivity—areas in which the ‘surplus’ countries like Germany have invested drastically more. Indeed, Germany [which increased its real (public) spending on R&D by 15% after the crisis] has also invested greatly in patient long-term committed finance, through its state investment bank KfW (as well as the local and regional banks); yet, this has not been viewed by Troika policy makers as key to Germany’s success story, thus the ‘conditions’ being imposed on the weaker EU countries, so they can become more like Germany, are not including key aspects of the German success story. And unfortunately, the prognosis does not look good, with financial companies like Goldman Sachs, as well as the large hedge funds, benefiting more than ever by what can only be described as countries down on their knees. We hope that this issue will help provide key policy measures that will bring finance closer to the real economy, providing new frameworks through which to link finance, innovation, and equitable economic growth.

Acknowledgements

The author gratefully acknowledges funding from the European Community’s Seventh Framework Programme (FP7/2007-2013) under Socio-economic Sciences and Humanities (FINNOV, 217466), as well as funding from the Institute for New Economic Thinking (Financing Innovation, INET INO1200036).

References

- Abraham, J. (2011), ‘Evolving sociological analyses of ‘pharmaceuticalization’: a response to Williams, Martin and Gabe,’ *Sociology of Health and Illness*, 33(5), 726–728. ISSN 0141–9889.
- Alessandri, P. and A. Haldane (2009), ‘Banking on the State,’ *Bank of England* (November 2009).
- Bottazzi, G., M. Grazzi, A. Secchi and F. Tamagni (2011), ‘Financial and economic determinants of firm default,’ *Journal of Evolutionary Economics*, 21(3), 373–406.

- Block, F.L. and M.R. Keller (eds) (2011), *State of Innovation: The U.S. Government's Role in Technology Development*. Paradigm Publishers: Boulder, CO.
- Brown, J., S. Fazzari and B. Peterson (2009), 'Financing innovation and growth: cash flow, external equity, and the 1990s R&D boom,' *Journal of Finance*, **64**, 51–185.
- Brossard, O., S. Lavigne and M.E. Sakinç (2013), 'Ownership structures and R&D in Europe: the good institutional investors, the bad and ugly impatient shareholders,' *Industrial and Corporate Change*, **22**(4), 1031–1068.
- Cosh, A., A. Hughes, A. Bullock and I. Milner (2009), 'SME finance and innovation in the current economic crisis,' Centre for Business Research, University of Cambridge, http://www.cbr.cam.ac.uk/pdf/CrCr_EconCrisis.pdf.
- Dore, R. (2008), 'Financialisation and the global economy,' *Industrial and Corporate Change*, **17**(6), 1097–1112.
- Dosi, G. and R. Nelson (1994), 'An introduction to evolutionary theories in economics,' *Journal of Evolutionary Economics*, **4**(3), 153–172.
- Dosi, G. (1990), 'Finance, innovation and industrial change,' *Journal of Economic Behavior and Organization*, **13**, 299–319.
- Dosi, G. (2005), 'Statistical regularities in the evolution of industries. A guide through some evidence and challenges for the theory,' *LEM Working Paper Series*, 2005/17.
- FINNOV (2010), *Do Financial Markets Reward Innovation?* FINNOV Policy Brief (January 2010), <http://www.finnov-fp7.eu/publications/finnov-policy-papers/finnov-first-policy-brief-do-financial-markets-reward-innovation>. Accessed 7 June, 2012.
- Geroski, P.A. and M. Mazzucato (2002), 'Myopic selection,' *Metroeconomica*, **53**(2), 81–199.
- Gompers, P. and J. Lerner (2004), *The Venture Capital Cycle*. 2nd edn. MIT Press: Cambridge, MA.
- GWEC (2012), 'Global Wind Report: Annual Market Update 2011,' [www] GWEC.org. Global Wind Energy Council, http://www.gwec.net/fileadmin/documents/NewsDocuments/Annual_report_2011_lowres.pdf. Accessed 5 December, 2012.
- Hall, P. and D. Soskice (eds) (2001), *Varieties of Capitalism. The Institutional Foundations of Comparative Advantage*. Oxford University Press: Oxford, UK.
- Hopkins, M.M., P.A. Crane, P. Nightingale and C. Baden-Fuller (2013), 'Buying big into biotech: scale, financing and the industrial dynamics of UK biotech, 1980–2009,' *Industrial and Corporate Change*, **22**(4), 903–952.
- Hopkins, M. and W. Lazonick (2012), *Soaking Up the Sun and Blowing in the Wind: Renewable Energy Needs Patient Capital* [www] Working paper. Airnet, http://www.theairnet.org/files/research/Hopkins/CleanTechPatientCapital_20121129a.pdf. Accessed 1 December, 2012.
- Hughes, A. (2008), 'Entrepreneurship and innovation policy: retrospect and prospect,' *Political Quarterly*, **79**(1), 133–152.
- ICB (2011), Vickers Commission (The Independent Commission on Banking) Final Report, <http://bankingcommission.s3.amazonaws.com/wp-content/uploads/2010/07/ICB-Final-Report.pdf>. Accessed 14 November, 2011.

- Jensen, M. (1986), 'Agency costs of free cash flow, corporate finance, and takeovers,' *American Economic Review*, **6**(2), 323–329.
- Kay, J. (2012), 'The Kay review of UK equity markets and long-term decision making: final report,' [www] Independent Report from Inside government, Gov.uk (July 2012), <https://www.gov.uk/government/publications/the-kay-review-of-uk-equity-markets-and-long-term-decision-making-final-report>. Accessed 1 March, 2012.
- Keynes, J.M. (1926), *The End of Laissez-Faire*. L and V Woolf: London, UK.
- Klepper, S. (1997), 'Industry life cycles,' *Industrial and Corporate Change*, **6**, 145–183.
- Knight, F. (1921), *Risk, Uncertainty and Profit*. Hart, Schaffner & Marx: Boston, MA.
- Lazonick, W. (2007), 'The US stock market and the governance of innovative enterprise,' *Industrial and Corporate Change*, **16**(6), 983–1035.
- Lazonick, W. (2013), 'The financialization of the US corporation: what has been lost, and how it can be regained,' *Seattle University Law Review*, **36**(2), 857–909.
- Lazonick, W. and M. O'Sullivan (2000), 'Maximizing shareholder value: a new ideology for corporate governance,' *Economy and Society*, **29**(10), 13–35.
- Lazonick, W. and O. Tulum (2011), 'US biopharmaceutical finance and the sustainability of the biotech business model,' *Research Policy*, **40**.
- Lazonick, W. and M. Mazzucato (2013), 'The risk-reward nexus in the innovation-inequality relationship: who takes the risks? who gets the rewards?' *Industrial and Corporate Change*, **22**(4), 1093–1128.
- Mazzucato, M. (2013), *The Entrepreneurial State*. Anthem Press: London, UK.
- Mazzucato, M. and M. Tancioni (2012), 'Stock price volatility, R&D and patents,' *Journal of Evolutionary Economics*, **22**(4), 811–832.
- Metcalfe, J.S. (1994), 'Competition, Fisher's Principle and increasing returns to selection,' *Journal of Evolutionary Economics*, **4**, 327–346.
- Mina, A., H. Lahr and A. Hughes (2013), 'The demand and supply of external finance for innovative firms,' *Industrial and Corporate Change*, **22**(4), 869–901.
- Minsky, H. (1990), 'Schumpeter: finance and evolution,' in A. Heertje and M. Perlman (eds), *Evolving Technology and Market Structure: Studies in Schumpeterian Economics*. The University of Michigan Press: Ann Arbor, MI, pp. 51–74.
- Minsky, H. (1993), 'Schumpeter and finance,' in S. Biasco, A. Roncaglia and M. Salvati (eds), *Markets and Institutions in Economic Development: Essays in Honour of Paolo Sylos Labini*. St. Martin's Press: New York, NY, pp. 103–115.
- Minsky, H.P. (1992), *The Capital Development of the Economy and The Structure of Financial Institutions*. Levy Institute Working Paper No. 7 (January 1992).
- Mirowski, P. (2011), *Science-mart: Privatising American science*. Harvard University Press: Boston, MA.
- Montalban, M. and M.E. Sakiñç (2013), 'Financialization and productive models in the pharmaceutical industry,' *Industrial and Corporate Change*, **22**(4), 981–1030.

- Mowery, D.C. (2010), 'Military R&D and innovation,' in B. H. Hall and N. Rosenberg (eds), *Handbook of the Economics of Innovation*. North-Holland: Amsterdam, The Netherlands.
- NESTA (2009), *From Funding Gaps to Thin Markets: UK Government Support for Early-Stage Venture Capital*, [www] Research report, <http://www.nesta.org.uk/library/documents/Thin-Markets-v9.pdf>. Accessed 7 June, 2011.
- Nelson, R. and S. Winter (1982), *An Evolutionary Theory of Economic Change*. Harvard University Press: Cambridge, MA.
- Nightingale, P. and A. Coad (2013), 'Muppets and gazelles: ideological and methodological biases in entrepreneurship research,' *Industrial and Corporate Change*, forthcoming.
- Pavitt, K. (1984), 'Sectoral patterns of technical change: towards a taxonomy and a theory,' *Research Policy*, **13**, 343–373.
- Perez, C. (2002), *Technological Revolutions and Financial Capital: The Dynamics of Bubbles and Golden Ages*. Edward Elgar: Cheltenham, UK.
- Pisano, G.P. (2006), 'Can science be a business? lessons from biotech,' *Harvard Business Review*, 114–125.
- O'Sullivan, M. (2005), 'Finance and innovation,' in J. Fagerberg, D. Mowery and R. R. Nelson (eds), *The Oxford Handbook of Innovation*. Oxford University Press: Oxford, UK.
- Revest, V. and A. Sapio (2013), 'Does the alternative investment market nurture firm growth? a comparison between listed and private companies,' *Industrial and Corporate Change*, **22**(4), 953–979.
- Schumpeter, J.A. (1912), *The Theory of Economic Development*, trans. by R. Opie from the 1926 (revised) edition of *Theorie der Wirtschaftlichen Entwicklung*, London: Oxford University Press, 1961.
- Schumpeter, J. (1992/1942), *Capitalism, Socialism and Democracy*. Routledge: London, UK.
- Stirling, A. (2009), *Direction, Distribution and Diversity: pluralising progress in innovation, sustainability and development*, STEPS Working Paper 32, Brighton: STEPS centre.
- Storey, D. (2006), 'Evaluating SME policies and programmes: technical and political dimensions,' in M. Casson, B. Yeung, A. Basu and N. Wadeson (eds), *The Oxford Handbook of Entrepreneurship*. Oxford University Press: New York, NY, pp. 248–279.
- Taleb, N.N. (2010), *The Black Swan: The Impact of the Highly Improbable*. Random House Trade Paperbacks: New York, NY.
- Tylecote, A. and F. Visintin (2008), *Corporate Governance, Finance, and the Technological Advantage of Nations*. Routledge: London.
- Vitali, S., G. Tedeschi and M. Gallegati (2013), 'The impact of classes of innovators on technology, financial fragility, and economic growth,' *Industrial and Corporate Change*, **22**(4), 1069–1091.
- Wray, L.R. (2010), 'What do Banks do? A Minskian Analysis,' *Levy Institute Public Policy Brief No. 115*.