The Risk-Reward Nexus in the Innovation-Inequality Relationship

Who Takes the Risks? Who Gets the Rewards?

by William Lazonick and Mariana Mazzucato

Abstract. We present a new framework, called the Risk-Reward Nexus, to study the relationship between innovation and inequality. We ask: What types of economic actors (workers, taxpayers, 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 if and when they appear? That is, who takes the risks and who gets the rewards? We argue that is the collective, cumulative, and uncertain characteristics of the innovation process that make this disconnect between risks and rewards possible. When, across these different types of actors, the distribution of financial rewards from the innovation process reflects the distribution of contributions to the innovation process, innovation tends to reduce inequality. When, however, some actors are able to reap shares of financial rewards from the innovation process that are disproportionate to their contributions to the process, innovation increases inequality. The latter outcome occurs when certain actors are able to position themselves at the point where the innovative enterprise generates financial returns; that is, close to the final product market or, in some cases, close to a financial market such as the stock market. In this paper we 1) develop the Risk-Reward Nexus framework on the basis of a theory of innovative enterprise, 2) critique the leading economic ideologies that, by distorting the relation between risks and rewards, have justified growing inequality over the past three decades or so, and 3) apply the analysis to the trajectories of both innovation and inequality in the US economy since the 1970s. We conclude by sketching out key policy implications of the Risk-Reward Nexus approach.

Key Words: innovation, risks, rewards, growth, inequality.

JEL Classification: 014; 015; 031

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1. An urgent problem

Inequality has hit the front pages, not only because it has been increasing (Figure 1), but because there is a sense that in the relatively good times (e.g., the 1990s), the rich got an unfair proportion of the rewards, and in very bad times (e.g., the 2008-2009 financial crisis), they got off the hook without paying their share. However, the battle against increasing inequality has had little success, as witnessed in the failed attempt to curb bank bonuses after the crisis. A prime reason for this failure is a lack of understanding about how income inequality is connected to processes of wealth creation. Economists have discussed inequality in terms of the welfare state (Wilkinson 2005), globalization (Mazur 2000), de-unionization (Freeman 1992), and the changing skill base (Acemoglu 2002; Brynjolfsson 2011).

In this paper, we argue that to understand income inequality it is critical to focus on its relationship with innovation, and specifically in the failure of the distribution of risk taking in innovation to be reflected in the distribution of rewards. Indeed, while risk-taking has become more collective—leading to lots of talk about ‘open innovation’ and the importance of innovation ‘ecosystems’—the reward system we argue has become dominated by individuals who, inserting themselves strategically between the organization and the market, lay claim to a disproportionate share of the rewards of the innovation process.

We choose this innovation perspective for two reasons. Firstly, while innovation has the potential to raise the general standard of living, a necessary even if not sufficient condition for this outcome is that the returns to innovation are distributed in a way that is commensurate with the contributions that different economic actors (including workers and taxpayers) have made to the innovation process. And secondly, in recognition of the central importance of innovation to raising standards of living, the most widely promulgated national and transnational (EC) strategies target ‘smart’ growth and ‘inclusive’ growth together (EC 2020, OECD 2011). Yet the economics profession has thus far failed to provide a sound theory of the relation between innovation and inequality. We believe that in the absence of a cogent and logical theoretical understanding of how innovation and inequality are related, strategies for smart, inclusive growth are ad hoc and are likely to have little effect.
A major barrier to the analysis of the relation between innovation and inequality is the division of labor among economists between those who study each of these two phenomena, and their mutual neglect of the role of financial institutions in linking the two. While the relation between the production of output and the distribution of income was a concern of nineteenth-century classical economists such as David Ricardo and Karl Marx, research is now conducted on the basis of a largely unintegrated division of labor in which labor economists work on inequality, and industrial economists on technology – with both these groups typically ignoring the role of finance in the economy.

Since both innovation and income distribution depend fundamentally on the investment strategies and organizational structures of business enterprises, we need a theory of innovative enterprise that can explain both the creation of value and its distribution among participants in the firm. A theory of innovative enterprise must integrate an understanding of the interaction of strategy, organization, and finance in the generation of higher quality, lower cost products than had previously been available (Lazonick 1991 and 2010; O'Sullivan 2000). We need a theory of innovative enterprise to explain how over time the economic system augments its value-creating capability and the potential for higher standards of living. If we do not have a theory of value creation, how can we have a theory of the relation between value-created and value-extracted? That is precisely what the Risk-Reward Nexus (RRN) approach aims to analyze.

It is important to be clear about what we mean by ‘value’. While classical economists had an ‘objective’, or supply-side, theory of value (tied to the labor theory of value), neoclassical economists replaced it with a subjective, or demand-side, theory of value, where the price of a commodity is related to individual preferences. The value of a good or service depends on both the cost of producing it and the demand for its use. The costs of production include the effort expended by workers. Even if one can assume that workers choose the amount of effort that they wish to supply for a given wage, there is the question of whether more effort, and hence more productivity, can be induced by offering workers a higher share of the productivity gains, as argued in the literature on “efficiency wages” (Akerlof and Yellen 1986). What, however, over the long run, permits real productivity gains, and hence higher standards of living is not people working harder for higher wages, but rather “effort-saving” technological change, which, when it results in products that can be sold on the market, creates the potential for workers to receive higher wages for a given amount of effort.
In this paper, we argue that the analysis of the creation and distribution of value through effort-saving technological change requires a theory of the innovation process as both collective and cumulative.

Innovation, however, is also uncertain because when investments in the collective and cumulative innovation process are being made, there is no guarantee that the enterprise will be able to generate a higher quality, lower cost product. If we knew how to innovate when these investments are being made, the process would not be innovation. And because innovation is involved, the achievement of a successful outcome is non-probabilistic—it is deeply “uncertain” (Knight 1921). Yet, notwithstanding this uncertainty, people contribute effort and money to the innovation process without a guaranteed return. That is, in the face of uncertainty, they make their own personal calculations about the “rewards” that may result from participation in the innovation process which induce them to take “risks”. Our argument is that this “risk-reward nexus” is of central importance for understanding not only the collective and cumulative innovation process but also the distribution of the gains from innovation that can result from it.

In Section 2 of this paper, we lay out the conceptual foundations for understanding how innovation may be related to inequality by focusing on its core characteristics -- the uncertain, collective, and cumulative character of the innovation process. In Section 3, we then sketch out the “Risk-Reward Nexus” framework for analyzing the innovation-inequality dynamic. In Section 4, we use this framework to provide an historical overview of how over the past few decades in the United States “financialized” modes of resource allocation have become characteristic of both high-tech startups and established companies, increasing income inequality while undermining the innovation process. In Section 5 we compare the Risk-Reward Nexus to the Skill-Biased Technical Change (SBTC) framework for understanding the relation between, and the policy implications of, “technological change” and inequality.

2. The uncertain, collective and cumulative character of innovation

A theory of the innovative enterprise must begin with the fundamental fact that innovation is inherently uncertain. It is not just risky as posited by endogenous growth theory, which assumes that R&D can be modeled as a lottery (Romer 1990). The innovation process is
uncertain in the Knightian sense that one cannot calculate a probabilistic stream of financial returns at the time when investments of effort and money in the innovation process are made (Knight 1921; Mazzucato and Tancioni 2012). At those points in time at which people contribute their labor and capital to investments in innovation, one cannot know whether innovation will be a success. In fact, innovative investments usually result in failure. Yet in the face of uncertainty, investments in innovation are made. Investments that can result in innovation require the strategic allocation of productive resources to particular processes to transform particular productive inputs into higher-quality, lower-cost products than those goods or services that were previously available. Investment in innovation is a direct investment that involves, first and foremost, a strategic confrontation with technological, market, and competitive uncertainty (Lazonick 2010).

The uncertain character of the innovation process often means that government innovation policies have to support the contributions of those parties to the innovation process who bear risk (Mazzucato 2011). In effect, the government – i.e., the collectivity of taxpayers – assumes part of the risk that households and businesses would not be willing to bear if they had to invest in the innovation process on their own. Moreover, within business enterprises, workers, and not just financiers or capitalists bear risk when they exert effort now with a view to sharing in the future gains from innovation if and when these gains materialize (Lazonick 1990). Indeed the innovation process generally requires the organizational integration of a complex hierarchical and functional division of labor within the firm and often across vertically or horizontally related firms. Besides being uncertain, the innovation process is therefore collective, and it is the collectivity of taxpayers, workers, and financiers who to different degrees bear the risk of innovative enterprise.

The “national innovation system” approach has highlighted the roles in the innovation process of the different actors (financial institutions including banks and venture capital, government agencies, universities, shop floor workers, engineers), and the important horizontal relationships between them, industry-science links and user-producer relations (Freeman 1995). As a foundation for the innovation process, the government typically makes investments in physical and human infrastructure that individual employees and business enterprises would be unable to fund because of a combination of the amount of fixed costs that investment in innovation requires and the degree of uncertainty that such investment
entails. These fixed costs include the size of the investments that must be made and the duration of time required from the making of the investments to the generation of returns.

Government investments have also been the backbone of the most successful innovations, from the Internet to nanotech (Block and Keller 2010). Neoclassical economists construe this state involvement as fixing ‘market failures’. From the perspective of the theory of innovative enterprise, however, a more apt description of government’s role is “opportunity creation”. Mazzucato (2011) has argued that the State’s willingness to dare to invest in the most high-risk uncertain phase of a new sector’s development, can be understood in terms of making and shaping markets, not fixing markets that do not work. Nanotech would never have come about without the visionary strategy of civil servants in the US National Science Foundation and National Nanotechnology Initiative (the type of “crazy-foolish” behavior that the late Apple CEO Steve Jobs has said is essential for innovation). It is plainly wrong to assume that the willingness to invest was there in the business sector, and all government had to do was to create the right “framework conditions”. The State led, putting its capital at risk, at a time when the business sector was not willing to engage. Thus, while Keynes emphasized the need for the State to inject demand into the down side of the business cycle, the reality is that even in periods of growth, without the State the capitalist machine will not take off.

The State also subsidizes the investments that enable individual employees and business enterprises to participate in the innovation process. Academic researchers often interact with industry experts in the knowledge-generation process. Within industry there are research consortia that may include companies that are otherwise in competition with one another. There are also user-producer interactions in product development within the value chain. In effect, taxpayers fund these inputs into the innovation process as part of a societal effort to augment the future wealth of the nation. There is an expectation that if and when innovation is successful, a share in the gains will flow back to society through taxation, job creation, and generally higher standards of living.

Workers also contribute time and effort to the innovation process with the expectation of sharing in the gains from innovation if and when the firm is successful (Lazonick 1990 and 1998). To be sure, firms have to pay workers wages today even for work that may only pay off tomorrow. But, as is generally recognized by businesses that declare that “our most important assets are our human assets”, the key to successful innovation is the *extra* time and
effort that employees expend interacting with others to confront and solve problems in transforming technologies and accessing markets, above and beyond the strict requirements of their jobs. Anyone who has spent time in a workplace knows the difference between workers who just punch the clock to collect their pay from day to day and workers who use their paid employment as a platform for the expenditure of creative and collective effort as part of a process of building their careers. We posit that the productivity differences between the two types of workers can be enormous, and that it will only be firms within which the latter culture predominates that will have a chance of innovative success.

Innovation is collective in that it requires social interaction in a learning process that integrates the skills and efforts of significant numbers of people in a hierarchical and functional division of labor. That is, innovation is an organizational, not a market, process. As a result the sharing of the gains of innovation – that is, the rewards – among the various parties is determined by social relationships rather than by market prices. Given the centrality of organization to the innovation process and the centrality of innovation to economic growth, Lazonick (2011) argues that economics requires a theory of “organizational success”, not a theory of “market failure”.

Social institutions can structure and regulate these social relationships so that they distribute the gains of innovation in ways that create incentives for members of these social organizations to supply their labor and capital to the innovation process. Indeed, as a dynamic process that depends on cooperation (i.e., the expenditure of effort in a collective process), it can be argued that a distribution of the gains of innovation that contributors view as fair will increase the amount of total gains to be distributed relative to the amount of total gains available when some of the parties to the innovation process deem the distribution of the gains to be unfair.

The development and utilization of productive resources that can result in innovation is a cumulative process that inherently takes time. The innovation process is cumulative because what one learns about how to transform technology and access markets today provides the foundation for what the different (collective) actors learn about transforming technology and accessing markets tomorrow. In the industry dynamics literature, it is in fact well known that innovation is characterized by “path dependency”: innovation today depends on innovation yesterday. And at the firm level, innovation is one of the variables that (unlike growth)
exhibits the most “persistence” as successful innovators today are often the successful innovators of tomorrow (Demirel and Mazzucato 2012). The cumulative character of the innovation process creates a need for committed finance – or what is often called “patient capital” – to sustain the innovation process from the time at which investments in innovation are made until the time at which those investments can generate returns. It is thus no surprise that those countries that have developed a wide array of different types of patient capital are also those that have managed to innovate consistently over the last century, and retain their leadership in key sectors (e.g., Germany in machine tools; Sweden in communications technology, and Japan in automobiles).

3. The Risk-Reward Nexus

By focusing on the uncertain, collective, and cumulative character of the innovation process, the Risk-Reward Nexus (RRN) framework asks who contributes their labor and capital to the innovation process and who reaps the financial rewards from it. Then we assess the equity of this risk-reward nexus, and ask whether this nexus supports or undermines the innovation process. Given the uncertain character of the innovation process, who bears risk is of central importance. Given the collective character of the innovation process, an understanding of how different economic actors contribute their labor and capital to the development and utilization of productive resources is of central importance. Given the cumulative character of the innovation process, and hence the inherent time-lag between making investments and generating returns, an analysis of whether the actors who appropriate the gains from the innovation process are the ones who previously bore the risk of investing in it is of central importance. The collective character of the innovation process makes it difficult to measure the contributions of different actors to it, while it is the cumulative character of the innovation process that enables some economic actors to “position” themselves strategically in order to extract more value (the integral under the curve that defines the innovation process) than the “value-added” that their marginal contributions of labor and capital create.

It is often assumed that shareholders are the only contributors to the economy who do not have a guaranteed return -- a central, and fallacious, assumption of financial economics based on agency theory (Jensen 1986). It is indeed this assumption that underpins the justification, in academia and the media, for shareholders (and those actors that have the most shares) getting so rich in periods of innovation led growth (e.g., the dot.com boom). The argument
assumes that shareholders are the “residual claimants” to whom net income belongs after all other economic actors – workers, suppliers, distributors, creditors – are paid their “guaranteed” rates. While, according to this theory, all the gains belong to shareholders, by the same token, as the only risk-takers in the economy, they have to bear all the losses as well. Hence the need, so the argument goes, for business corporations to “maximize shareholder value” to encourage risk-taking and the possibility of superior performance of the economy as a whole (Lazonick 2012).

The problem is that shareholder-value theory lacks a theory of innovative enterprise that can explain why and under what conditions, and with whose participation, the taking of risk results in innovation, i.e., higher quality, lower cost products. This perspective fails to comprehend the implications of the uncertain, collective, and cumulative character of the innovation process for the distribution of risk among economic actors and the distribution of rewards required to incentivize this risk-taking. In short, the ideology of maximizing shareholder value fails to comprehend the risk-reward nexus in the innovation process.

Firstly, insofar as public shareholders simply buy and sell shares and are willing to do so because of the ease with which they can liquidate these portfolio investments, they may make little if any contribution to the innovation process and bear little if any risk of its success or failure. Shareholders in public companies have enjoyed limited liability since the joint-stock legislation of the 19th century (subsequently this protection was extended to private shareholders through limited liability partnerships and companies). Second, and in contrast, as already indicated, governments funded by taxpayers may invest capital and workers may invest labor (effort) in the innovation process without any guarantee of a return commensurate with their investments. Early high-risk investments that the State makes when the business sector is not willing to invest have no guaranteed rate of return. A major source of inequality is the ability of economic actors to appropriate returns from the innovation process that are not warranted by their investments of capital and/or labor in it. Indeed, we argue that by diminishing the incentives and even the abilities of certain economic actors (taxpayers and workers) to contribute to the innovation process, inequality that derives from misappropriation in the risk-reward nexus can undermine the innovation process itself.

The collective character of the innovation process provides a foundation for inclusive growth; the very participation of large numbers of people in the innovation process means that
**inherent in the innovation process** is a rationale for the widespread and equitable distribution of the gains to innovation. These gains from innovation can either be reinvested in a new round of innovation or, alternatively, distributed to stakeholders as returns to labor or capital. Insofar as government agencies have used public funds to invest in innovation, the State has a claim to a share of the returns to innovation if and when they occur. The claims can take the form of general tax revenues, in which case their size will be dependent on the tax rate, or, as we discuss in the conclusion of this paper, special levies on those business enterprises that make the most use of, or gain the most from, government investments.

The State can allocate these gains to support innovation through infrastructural investments or through subsidies to businesses and households designed to encourage innovation. Alternatively the State can distribute the gains to innovation to the citizenry (whose tax payments funded the government investments in innovation) in the forms of tax cuts, tax credits, or government-provided services. An understanding of the risk-rewards nexus in the innovation process is critical to the formulation of these government policies. The cumulative character of the innovation process creates a role for finance to sustain the innovation process from the point in time at which investments are made until the point in time at which those investments generate financial returns. While what Lazonick (1992a and 2010) has called ‘financial commitment’ is a condition of innovative enterprise, the cumulative character of the innovation process can also provide an opportunity of those who control access to finance to withdraw that access before returns can be generated, even though from the perspective of those engaged in organizational learning the continuity of finance could result in innovative success (Lazonick and Tulum 2011). Particularly in the United States stock repurchases, justified by the ideology of “maximizing shareholder value”, have functioned as a mode of value extraction that generally undermines investment in innovation (Lazonick 2012).

It is customary for economists who are critical of distributional outcomes to call such value extractors “rent-seekers”. But the use of the term “rent” implies that the gains that these actors appropriate derive from gaining control over inherently scarce resources. The point of the innovation process, however, is to overcome scarcity by generating higher quality, lower cost products than were previously available; that is, by creating new sources of value. From this perspective, so-called rent-seekers are engaged in value extraction. They insert themselves strategically in exercising control over the returns from the innovation process, extracting a share of returns from the expanding economic pie that is in excess of their
contribution to the process that generated that expanding pie. In doing so, they – i.e., top executives, venture capitalists, Wall Street bankers, hedge fund managers – make the claim, explicitly or implicitly, that they are the risk-takers who were responsible for making the contributions to the innovation process that justify their high returns.

When, driven by innovation, the economic pie is growing, other economic actors, e.g., workers and taxpayers, may share in the gains as well through trickle-down effects. But in the subsequent economic decline, in part induced, we would argue, by the success of the value-extractors in concentrating returns in their own hands, workers and taxpayers typically lose out permanently even as the value-extractors use their control over corporate resource allocation to continue to look for ways to consolidate their gains. For example, in the Internet boom of the late 1990s, when, through stock-based remuneration, top corporate executives and high-tech venture capitalists were becoming extremely wealthy, tight labor markets resulted in rising real wages while the Clinton Administration ran budget surpluses in large part because of capital gains taxes on stock-market transactions. Then when the boom turned to bust, the US government found that it now had large deficits while many workers whose remuneration had benefited from the boom now found themselves without jobs. Meanwhile the value-extractors sought to restore their gains of the late 1990s through, for example, the Bush tax cuts, offshoring of jobs to low-wage areas of the world, and massive stock repurchases (Lazonick 2009a). During the 2000s, we would argue further, the success of these means of value-extraction ultimately undermined the innovation process itself.

Our Risk-Reward Nexus framework seeks to analyze the ways in which risks and rewards can be aligned among contributors to the innovation process so that the sharing of the gains to innovative enterprise is both equitable (and hence forms a foundation for less inequality) while promoting the growth of innovative enterprise. Given the need for business-government collaboration in funding the cumulative innovation process, those in the collaboration who exercise strategic control over the allocation of resources need to have a framework for assessing the ongoing risks of investments in innovation, with key participants in the organizational learning process involved. A risk-reward nexus understanding of innovation provides strategic decision-makers in business and government with a more inclusive and less financialized approach to the relation between economic performance and income inequality than the dominant “shareholder value” paradigm. This understanding of the risk-reward nexus in the innovation process will enable the relevant stakeholders to make
collaborative decisions to invest in innovation in the first place and sustain the process until it can generate returns on an equitable basis to the different types of economic actors who participate in the process.

4. Financial Actors and Value Extraction

If, as we have argued, the collective character of the innovation process provides a foundation for an equitable distribution of income, how is it that certain economic actors are able to extract for themselves disproportionate amounts of the value that the innovation process creates? They accomplish this feat by positioning themselves along the cumulative curve of innovation, and extracting at a given point in time much more than what they have contributed. This value extraction is done through various institutional mechanisms such as political lobbying for de-regulation, lower tax rates, and special subsidies, inside control over speculative stock issues, and legal manipulation of the stock market through stock buybacks.

The proponents/beneficiaries of these institutional mechanisms extol the virtues of a “free market” economy. Yet it is organizations, not markets that create value in the economy. Historically, well-developed markets are the result, not the cause of economic development that is driven by organizations in the forms of supportive households, innovative enterprises, and developmental states (Lazonick 2003 and 2011). Well-developed markets in inputs and outputs can enhance the ability of the possessors of capital and labor to extract value. But markets do not create value. Any economy requires both the creation (i.e., production) and extraction (i.e., distribution) of value. For example, whenever a worker gets paid a wage he or she extracts value. The source of inordinate income inequality is not value extraction per se, but rather the positioning of people who have control over large amounts of finance capital to make use of financial markets or product markets to extract far more capital than they create. Rather than income being distributed equitably (which of course does not necessarily mean equally) according to the value that different economic actors create, certain types of economic actors are able to make use of both the reality and ideology of markets to extract disproportionate amounts of value for themselves.

It has long been recognized that financial fortunes are generated suddenly, ostensibly through the capitalization of future profit potential into the market price of an asset, rather than patiently through the accumulation of re-invested capital income (e.g., Thurow 1975). Financial deregulation and the spread of stock-related pay have enabled investors (especially
of private equity) and top corporate executives to secure ownership of assets just before major innovation-related gains are capitalized into them. Capital gains tax reduction has served to augment those gains. When financial markets become more speculative, the moment of capitalization has tended to move forward in time, so that it can often occur before any marketable products have been unveiled or a profitable business model established. IPOs and acquisitions are commonly the moment of capitalization, especially as IPO stock tends to be deliberately underpriced to ensure oversubscription. Sometimes the announcement of a technological breakthrough is enough to cause a jump in the stock price of companies exposed to it, enabling those strategically positioned to cash in.

Let us give two important examples based on the US experience of how this excessive value-extraction process works. One comes from the world of high-tech startups, and the other comes from the world of established business corporations.¹ In effect, we will be arguing that people like Mark Zuckerberg of Facebook, one of the world’s richest people with the company’s IPO in May 2012, or John Chambers of Cisco, who as CEO had total remuneration of $12.9 million in 2011 and $662 million from 1995 through 2011, have used financial markets to extract far more value than they create. In making this argument, we are not criticizing these individuals per se but rather a set of institutions that, while enabling, and even extolling, the ability of these individuals to extract value, fails to recognize the relation between risks and rewards that creates value.

*Value extraction through high-tech startups:*

In October 1980 Genentech, founded in 1976 by venture capitalists and scientists, was the first dedicated biopharmaceutical company to do an IPO. In December 1980 Apple Computer, a company that had been founded in a garage just four years earlier, did the largest IPO since Ford Motor Company (then over a half century old) had gone public in 1956. Since then in the United States venture-backed IPOs have become a distinguishing feature in both the biopharmaceutical and information and communication technology (ICT) industries (Kenney and Florida 2000; Lazonick 2009b, ch. 2; Lazonick and Tulum 2011). An IPO capitalizes value gains that have been generated over many years by many people – and

¹ We have deliberately chosen examples that draw primarily on the experience of the industrial sector or the economy because much if not most of the popular discussion on the rise of income inequality focuses on the machinations of the financial sector, i.e., Wall Street. While financial services can add value to the economy, the industrial sector forms the foundation for innovation in the types of goods and services that have the preponderant influence on our living standards.
hands those gains to a tiny group who often were not the original innovators or risk-takers but who nevertheless are currently positioned to appropriate much or all the profit. This type of value extraction also happens with IPOs of companies that were previously mutually- or family-owned, as their “trapped equity” is suddenly capitalized and paid out to the people who devised the flotation. That equity is the summation of other people’s ingenuity and risk-taking, often captured by people who exhibited none.

In the ICT industry, high-tech startups have been at the center of a technological revolution that is still being played out in areas such as mobile communications, social networking, and cloud computing. In biopharmaceuticals, a number of high-tech startups from the early 1980s such as Genentech, Amgen, Genzyme, and Biogen Idec ultimately generated blockbuster drugs (defined as at least $1 billion in sales in any one year), although through 2009 the number of blockbusters generated by the industry numbered only 30 (Lazonick and Tulum 2011). Since the early 1980s in Silicon Valley, by far the most dynamic industrial district for high-tech startups, tens of thousands of venture capitalists, founders, top executives, and early-stage employees have become multimillionaires. The huge gains that were already accruing to these economic actors in the IPO boom of the early 1980s set in motion a process of raising the norms for rewards in the economy that would, in ways that we outline below, set off a quest for higher levels of remuneration among CEOs of established companies. Indeed, the new norms of compensation were often set by a small but very significant number of startups such as Intel, Sun Microsystems, Oracle, and Cisco Systems that generated huge returns to venture capitalists, founders, and top executives and grew to employ tens of thousands of people. Companies such as these are usually presented as “sui generis” private-sector success stories, whose CEOs deserve their mega-wealth because they took great personal risks in pursuit of daring visions that captured major new industries for the United States. In fact, a set of socially-devised institutions related to corporate governance, stock markets and income taxation have permitted this concentration of value extraction in a few hands.

These high-tech startups would not have been able to come into existence but for decades of investment by the US government in ICT and biotech. As the historian Stuart Leslie (1993 and 2000) has documented, the foundation for the emergence of Silicon Valley was the military-industry complex that became implanted in the region during and after World War II, and particularly in the Cold War context of the 1950s. Silicon Valley’s first formal venture
capital firm, Draper, Gaither, and Anderson, founded in 1959, was headed by two former generals in the US Armed Forces, William H. Draper, Jr. and Frederick L. Anderson, and the former head of the Ford Foundation, H. Rowan Gaither, whose name is on the secret 1957 report submitted to President Eisenhower on how the United States should respond to the Soviet Union’s launching of Sputnik (Business Week 1960). The high-tech district that was to become known as Silicon Valley (a term that was coined in 1971) was either producing directly for the military or, increasingly from the last half of the 1960s, spinning off military technology for commercial uses (Lazonick 2009b, ch. 2). In this, Silicon Valley was imitating the previous development of the Route 128 high-tech district in the Boston area, based on military technologies developed at nearby universities, especially the Massachusetts Institute of Technology (Hsu and Kenney 2004)

Military technologies that were later commercialized were developed by tens of thousands of scientists, engineers, and other technical personnel in research labs of larger ICT companies including AT&T, General Electric, IBM, Sylvania, Xerox, Motorola, and Texas Instruments. Some employees left to found startups, but the ability to attract capital to finance startups required a number of other institutional changes that were put in place from the late 1950s. In 1958 the US government’s Small Business Administration (SBA), itself set up in 1953, launched the Small Business Investment Company (SBIC) program to provide subsidies to the formation and growth of startups. Many firms in the nascent venture-capital industry of the 1960s availed themselves of funds from SBIC (Rubel and Noone 1970).

Meanwhile, starting with what is known as the “Special Study” of securities markets submitted to the US Congress in 1963, the US Securities and Exchange Commission (SEC) encouraged the National Association of Security Dealers (NASD), a private non-profit organization charged with regulating the trading activities of its members, to make use of advances in computer technology to establish a national electronic quotation system for Over-The-Counter (OTC) stocks. The result was the creation of the National Association of Securities Dealers Quotation system, or NASDAQ, in February 1971. Unlike the New York Stock Exchange (NYSE), which had stringent listing requirements in terms of capitalization and a record of profitability, NASDAQ, like the OTC markets that it aggregated, afforded startups with low capitalization and no profits the possibility of doing an IPO. With the creation of NASDAQ, there now existed a highly liquid market in highly speculative corporate securities that provided venture capitalists and other financiers of startups with the
possibility of a relatively quick exit from their investments. Thus the development of this speculative stock market attracted venture capital into the ICT industry.

NASDAQ’s liquidity is particularly high because, unusually for an OTC exchange, it has hundreds of market-makers, usually more than one per stock. They ensure instant purchase or sale close to the market price, and underwriting for IPOs. Investors, as a result, have very little liquidity risk. The risk is transferred to market-makers who are backed by investment banks which, we now know, are underwritten by government. In effect, through NASDAQ, the profits of innovation have been privatized and its risks socialized.

In 1972 Silicon Valley venture capitalists, most of whom came out of the microelectronics industry, began to coalesce into a defined industry when a number of them, including Kleiner Perkins and Sequoia, co-located at 3000 Sand Hill Road in Palo Alto, near Stanford University. Also at that location was the Western Association of Venture Capitalists which in 1973 formed the foundation of the National Venture Capital Association (NVCA), a business lobby that in the late 1970s was in the forefront, along with the American Electronics Association (AeA), which also emanated from Silicon Valley, in convincing the US Congress to lower the capital-gains tax rates from almost 40% in 1976 to as low as 20% in the early 1980s. After riding the wave of State investments, therefore, venture capital proceeded to aggressively decrease the size of the purse that funded it.

Poised to reap speculative gains at low tax rates via a quick exit on NASDAQ, the venture capitalists needed to gain access to large amounts of capital. By the early 1980s workers’ pensions provided the biggest source of venture-capital funds. During most of the 1970s, however, the huge reserve of unions’ defined-benefit pensions, most of which were managed by major corporate employers, had been unavailable to the venture-capital industry. The passage in 1974 of the Employee Retirement Income Security Act (ERISA) had provided government guarantees for workers’ pensions and had ruled that pension-fund managers could be personally liable if they did not follow the “prudent man” rule in investing workers’ money. Pension-fund managers were, as a result, reluctant to invest in venture-capital funds. Intense lobbying by the NVCA and AeA, however, helped to convince the US government to issue a clarification of ERISA that stated that pension-fund managers could put as much as five percent of the fund into risky assets such as venture-capital funds, and still be deemed to
acting prudently. As a result, from the second half of 1979 vast amounts of workers’ capital poured into the venture capital industry.

While there are different ways in which a venture-capital firm can be organized, by the 1980s the limited partnership became the dominant form. The limited partners are the pension funds or other outside investors who entrust their money to the venture capitalists who, as the general partners, decide how to invest the closed-end (usually ten-year) fund capital. The venture capitalists typically receive a management fee equal to 2 percent of the entire fund plus 20 percent “carried interest” of all the fund’s profits.

The vast majority of venture-backed startups fail, and the returns to venture capital have been quite volatile across the business cycle (Gompers and Lerner 2002). Nevertheless, many venture capitalists and founders of high-tech firms have emerged since the 1980s as members of the super-rich. The lowering of the tax rate on capital gains and dividends to 15 percent, i.e., the Bush tax cuts of 2003, made them even richer.

To be sure, venture capitalists and other private-equity holders take risks, although even then mostly with other people’s (primarily workers’) money. But they have a vested interest in encouraging stock market speculation in the companies that they bring to market either through an IPO or, as an alternative mode of exit, an M&A deal. The allocation of access to shares in an IPO favors insiders, including the Wall Street banks that underwrite the deals, who, by keeping the float small, under-pricing the stock issue, and hyping the stock, encourage a post-IPO run-up in stock prices as the investing public clamors for the listed shares. Insiders then flip their holdings to make huge short-term gains. As was shown in a 2002 Fortune article entitled “You Bought. They Sold”, when the stock market is at a peak, insiders tend to cash in their own shares while encouraging outsiders to buy (Gimein et al. 2002).

The foundation for the emergence of the US venture-capital model was the rise of the microelectronics industry in Silicon Valley from the late 1950s (Kenney and Florida 2000; Lazonick 2009b, ch. 2). Given the investments in microelectronics by the US government and established business corporations in the post-World War II decades as well as the characteristics of both microelectronics technology and markets, it was possible for an ICT company to generate a commercial product within a few years after being founded, as indeed
was the case for companies such as Intel, Microsoft, Apple, Electronic Arts, and Cisco. With the founding of Genentech in 1976, however, the US venture-capital model was extended to the biopharmaceutical industry in which it would generally take at least a decade to generate a commercial product, with no certainty that in the end a viable drug would be developed.2

As Pisano (2006) has argued, the US venture-capital model would seem to be ill-suited to the biopharmaceutical industry. Venture capital looks to exit from its investments in at most five years. But it typically requires at least twice that amount of time to generate a biopharma drug that, having gone through stage 1, 2, and 3 clinical trials, the US Food and Drug Administration may deem effective and safe enough to market. Yet, as Pisano also recognizes, there are hundreds of publicly listed biopharma firms in the United States that have done their IPOs and then remain in business for years on end without a product. At best, these PLIPOS (product-less IPOs) generate revenues from R&D contracts with established pharmaceutical companies that in addition typically take equity stakes in them. In addition PLIPOS have been able to raise huge amounts of finance through IPOs and secondary stock issues (Lazonick and Sakinç 2010).

Lazonick and Tulum (2011) have shown that it is NASDAQ, i.e., the speculative stock market, that has enabled this business model to survive. Speculators, including hedge funds, are willing to buy and sell on news about R&D contracts won or cancelled and clinical trials that succeed or fail. The speculators do not expect to make their money because a biopharma firm has produced a successful drug, but rather through buying and selling stock. Given that over its 35-year history, the biopharma industry has generated some 30 blockbusters, speculators can always rationalize their demand for biopharma shares on the grounds that they are betting on the next blockbuster. In fact, however, by buying and selling stock, they can make or lose money on these bets irrespective of whether a successful drug is ever forthcoming. Given the massive amount of funds that have flowed into the US biopharmaceutical industry and the relatively small number of successful drug discoveries, the overall returns in terms of drug development have been small while financial interests, including highly remunerated biopharma executives, have done very well for themselves.

2 In 1975, Robert Swanson, a young partner at the Silicon Valley venture-capital firm of Kleiner Perkins, approached Herbert Boyer, co-inventor of gene splicing and a professor at the University of San Francisco, about doing a biopharma startup. Boyer’s main contributions to the new venture, Genentech, were his name and $500. Swanson became the CEO of Genentech, and in 1978 his former venture capital firm was renamed Kleiner, Perkins, Caufield and Byers, with Brook Byers as the biotech specialist.
The foundation for this speculative system of biopharma finance is US government spending on the life sciences knowledge base. Since the founding of its first research institute in 1938 through 2011, the National Institutes of Health (now made up of 27 centers and institutes) has appropriated $804 billion in 2011 dollars to fund this knowledge base. More than half of these funds have been appropriated since 1998. At $32 billion, the 2011 appropriations were in real terms more than twice their level in 1992 and more than three times their level in 1984. Between 1998 and 2003 the NIH budget increased by average of $2.7 billion, or 14.7 percent per year. Without this spending, the United States, and probably the world, would not have a biopharmaceutical industry.

Yet for all this government spending and the business funding that has flowed into the biopharmaceutical industry through private equity (including venture capital), IPOs, secondary stock issues, and R&D contracts, the biopharmaceutical industry has not been very productive (Demirel and Mazzucato, 2012). Most of the blockbuster biotech drugs that generated huge returns for both big pharma and biopharma companies reflect control over patent rights to the “low-hanging fruit” that became available to these companies in the 1980s as a result of decades of NIH funding. Meanwhile our research has shown that, in PLIPOs, economic actors who have invested in biopharma companies have been able to reap substantial returns for themselves even in the absence of a successful product (Lazonick and Sakiç 2010; Lazonick and Tulum 2011). The same applies to top executives of these companies who not only draw healthy salaries but also receive stock-based rewards that can bring them millions of dollars. Meanwhile US taxpayers keep funding these companies through the NIH. With tax rates low and few successful drugs that in any case bear prices that are about double those in any other country, however, taxpayers are seeing little in the way of a return.

In US high-tech startups gains from an IPO and subsequent stock price boosts are shared with employees through broad-based stock option plans. Prior to the rise of Silicon Valley startups, employee stock options were largely reserved for top executives to enable them to secure some of their remuneration at the capital-gains tax rate, which at 25 percent in the 1950s was far lower than the top marginal personal-income tax rate of 91 percent. In the 1960s and 1970s, however, the US Congress scaled down this tax privilege of top executives until it was eliminated completely in the Tax Reform Act of 1976. At the same time the
capital-gains tax rate was, as already mentioned, raised to almost 40 percent. Although, as we have also seen, the NVCA and AeA lobbied successfully, in the name of innovation, to get the capital-gains tax rate back down, this change was virtually irrelevant for options of employees exercised from broad-based plans because these options are almost always taxed at the personal-income tax rate. In 1980 the top marginal person income tax rate still stood at 70 percent. By 1988-1990 the Reagan “supply-side” revolution has brought it down as low as 28 percent.

Especially during the PC boom of the early 1980s, high-tech startups used broad-based stock options plans to induce professional, technical, and administrative employees to leave secure employment with established companies for inherently insecure employment in a new venture. If the startup would be able to make it to an IPO or an M&A deal, employees who had been granted stock options could do quite well, even though they might receive only a very small fraction of the stock-based gains going to venture capitalists, founders, and top executives. Indeed, in the Internet boom of the late 1990s, large numbers of employees at some of the leading companies did exceedingly well. As the most extreme case, at Microsoft in 2000, across some 39,000 employees (but not including the five highest paid executives), the average gains from exercising stock options was almost $450,000 (Lazonick 2009b, ch. 2).

At the same time, however, the average gains from exercising options of the five highest paid Microsoft executives was about 100 times that of the average gains of Microsoft employees (Lazonick 2009b, ch. 2). Moreover, employees who were hired in 2000 at the peak of the boom would in the subsequent years obtain zero gains from exercising stock options awarded that year as, like all other companies, Microsoft’s stock price plummeted with the Internet bust. Furthermore, in the 2000s all Microsoft employees, and particularly those in a high-wage nation such as the United States now were in danger of losing their jobs entirely through the globalization of the high-tech labor force. Indeed in May 2009 Microsoft announced that it was laying off 5,000 employees in its high-wage locations – its first mass layoff in its history. At the same time, also for the first time in its history, Microsoft, one of the most cash-rich companies in the world, took on $3.75 billion in debt – also a first in its history -- rather than incur the tax liability of repatriating its profits from abroad (Lazonick 2009a). The main purpose of the $3.75 billion in debt was to help fund Microsoft’s stock buybacks which ran to $14.6 billion in 2009 and would be another $18.8 billion in 2010 –
which brings us to the way in which the top executives of established companies like Microsoft engage in a massive process of value extraction.

5. Analytical and Policy Implications of an Organizational Failure View of Inequality

Analytical Implications

By generating real productivity gains, innovation can potentially increase the incomes of all participants in the process. It is because of this positive-sum potential that the European Union as well as the Obama administration have shown an interest in policies that can promote innovation-led growth (EC 2020; OECD 2011; Obama State of the Union 25/1/2011). Given the increases in income inequality in recent decades, however, what guidance do these policy-makers have in ensuring that the gains from innovation will be equitably shared among those parties, including taxpayers and workers, who participate in the innovation process?

The argument we have developed above provides a different interpretation of the relation between innovation and inequality than that offered by economists who have focused on the way that technologies, such as IT, displace the skills of some workers in favor of the skills of others (Brynjolfsson, 2011). In this concluding section, we contrast the analysis and policy implications of the Risk-Reward Nexus framework with the mainstream liberal perspective on growing inequality known as the “skill-biased technical change” (SBTC) approach (Aghion et al. 1999; Acemoglu, 2002).

Whereas the Risk-Reward Nexus framework views the prime driver in the increase in income inequality of the last three decades as the result of value-extractors control over resource allocation in business organizations, SBTC sees it in terms of the negative impact of technological change on the demand for “unskilled” (generally non-college educated) relative to “skilled” (generally college-educated) workers on the labor market. SBTC sees increasing income inequality as the result of market forces that change the balance of supply and demand. SBTC proponents argue that the government needs to intervene to correct this “market failure”. In contrast, the Risk-Reward Network approach sees the problem as an “organizational failure”. From our perspective, government policy should be designed to
make business organizations perform better. At the end of this concluding section, we will offer some general proposals on the types of government policies that may be required.

While SBTC makes “technical change” central to its analysis of the changing income distribution, it has no theory of innovation or even risk-taking. In neoclassical fashion, SBTC assumes that all agents in the economy are rewarded according to market-determined factor returns so that the changes in the wage distribution of income are the result of exogenous technology on the demand for different types of labor. SBTC theory looks at the effect of technological change on income distribution in terms of a market exchange between actors. As in market-oriented (i.e., neoclassical) economic perspectives generally, the SBTC approach does not analyze the origins of technological change. That is, it does not attempt to develop a theory of innovative enterprise. Hence when an author such as Aghion (1999) uses the term “innovation”, he is really talking about exogenous technological change that then, because of its skill-biased characteristics, affects the demand for labor.

For the proponents of SBTC, technological change has increased inequality because it has increased the set of complementary skills needed in the workplace and, given the supply of workers with these skills, the price that such skills fetch. SBTC seeks to measure this change empirically by the wage premium that college-educated (i.e., “skilled”) workers receive over less skilled (or “unskilled”) workers with only a high-school education. The critical assumption is that differences in income are determined by the laws of supply and demand in labor markets, with exogenous changes in technology altering the types of skills that are in demand. Given the growth in income inequality in the 1980s and 1990s, SBTC proponents assumed that a growing premium to college-educated workers was caused by the bias of the computer revolution of the time that increased the demand for the types of skills that college-educated workers have relative to less educated members of the labor force.

Equilibrium in this approach is affected by a “price effect”, which encourages the adoption of technologies directed at economizing on scarce factors, and a “market effect”, which leads to the adoption of technologies favoring abundant factors and complementary skills. The elasticity of substitution between these factors determines their relative power in determining how technological change (i.e., the diffusion of technology) and factor prices respond to changes in relative supplies. Thus both inequality and returns to skills are determined by supply and demand forces. The diffusion of technology is understood to occur in response to
profit incentives so when the adoption of skill-biased technologies is more profitable, the diffusion of technology will tend to be skill-biased. Acemoglu (2002) maintains that there has not been a “technological revolution” but simply a change in the type of technologies that are being adopted in response to such incentives.

Thus the key general difference between the RRN approach and the SBTC approach is whether it is organizations or markets that link technological change and income distribution. The RRN approach argues that organizations generate innovation, and that because of the collective, cumulative and uncertain character of the innovation process, certain economic actors can, by gaining control over the allocation of resources within these organizations, appropriate rewards from the innovation process that are disproportionate from the risks that they took in that process. The SBTC approach argues that markets determine both the diffusion of technology and the returns to different types of labor, with the skill-biased characteristics of that technology affecting the demand for labor with different types of skills. We contend that the RRN approach provides a superior explanation to the SBTC approach of the observed facts of income inequality in the United States.

The SBTC perspective has no explanation for the concentration at the top of the income distribution because all impacts of SBTC are on the distribution of income between skilled and unskilled workers. Looking at the changes in the percentage shares of the U.S. household distribution of income by quintiles from 1975 to 1995 (the time period that gave rise to the SBTC arguments), the percentage-point changes were -0.8 for the lowest quintile, -1.3 for the fourth quintile, -1.8 for the middle quintile, -1.4 for the second quintile, but +5.1 for the top quintile, including +4.5 for the top 5 percent of the household distribution of income (US Bureau of the Census 2012). The IRS return data analyzed by Piketty and Saez (2010) show a shift of +6.4 percent to the top 1% of the income distribution – from 8.95 percent of all income in 1975 to 15.23 percent in 1995, rising to as high as 22.82 percent in 2008. Put simply, in attempting to offer an explanation of the major shifts in income distribution that were taking place in the 1980s and 1990s, the SBTC approach chose the wrong target. In contrast, the RRN approach, we argue, is right on target in explaining the concentration of income at the top.

Even for the indicator that it chose to analyze – that is, the wage premium to college-educated workers, the SBTC approach cannot explain the narrowing of the wage premium in the 2000s
after it had widened in the previous two decades. In the 2000s, the demand for college-educated labor in the United States has been adversely affected by 1) the definitive end of the norm of career employment with one company in the business sector, a process that started in the early 1990s, and 2) the offshoring of the jobs of college-educated labor in the United States to make use of equally qualified labor that had emerged in lower-wage developing economies, specially China and India (Lazonick 2012). These changes were not imposed on U.S. business corporations by markets but rather were choices that their top executives made about the type of business models to adopt. These changes, that is, were driven by organizations, not markets.

The SBTC approach cannot explain inter-industry and inter-firm variations in rewards to given types of labor (see Bernstein and Mishel 2001). From the perspective of the theory of innovative enterprise in contrast, such differences are to be expected. Industries differ in terms of their technological, market, and competitive conditions and the dynamics of technological, market, and competitive transformation. Some industries such as pharmaceuticals require narrow and concentrated skill bases while others such as automobiles require broad and deep skill bases (Lazonick 1998; Lazonick and O’Sullivan 2002). Some industries such as such as ICT are characterized by rapid technological change while others such as homebuilding rely much more of traditional technologies. Some industries grow much more rapidly then others. Given Schumpeterian competition, moreover, we expect firms within an industry to differ, whereas it is a hallmark of neoclassical theory, and implicit in the SBTC approach, that all firms in an industry adopt the same technologies and have the same cost structures.

Within the collective and cumulative process that characterizes innovation, skills are not exogenously produced but often the result of endogenously created incentives. Returns to labor with different types of skill will reflect to some extent the innovation strategies and organizational structures of the firm. Top executives of certain business enterprises may choose to invest heavily in collective and cumulative learning, while, for the sake of short-term profits, the executives of competitors may decide to underinvest in training and human capital formation.

Like the neoclassical theory of the market economy in general, the SBTC approach ignores power. The RRN approach argues that inequality can arise when certain economic actors
position themselves along the cumulative process of innovation, and get much more out than they put in, regardless of their skills. Strategic decision-making power over the allocation of resources and returns comes from hierarchical position within business organizations not from education per se (for example, we do not as a rule see PhDs running corporations). In 2010, worldwide, the top 500 U.S. business corporations by revenue generated $10.8 trillion in sales, reaped $709 billion in profits, and employed 25.1 million people. The RRN approach argues that one cannot begin to explain either innovation or the distribution of income in the economy without an analysis of who exercises strategic control in these major business organizations, what types of investments they decide to make, and how these strategic decision-makers influence the allocation of returns.

References


