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Entrepreneurial Ventures and the Developmental State

Lessons from the Advanced Economies

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Abstract

A basic intellectual challenge for those concerned with the poverty of nations is to come to grips with the nature and causes of the wealth of the world's wealthier nations. One might then be in a position to inform the poorer nations how they might achieve similar outcomes. This paper is organized around what I call 'the theory of innovative enterprise', a perspective derived from the historical and comparative study of the development of the advanced economies. The theory of innovative enterprise provides the essential analytical link between entrepreneurship and development. Section 2 offers, as a point of departure, a contrast between entrepreneurship in rich and poor nations. Section 3 outlines the theory of the innovating firm in which entrepreneurship has a role to play. Section 4 identifies the roles of entrepreneurship in new firm formation in terms of the types of strategy, organization, and finance that innovation requires, and emphasizes the 'disappearance' of entrepreneurship with the growth of the firm. In Section 5 I argue that, in the advanced economies, successful entrepreneurship in knowledge intensive industries has depended heavily upon a combination of business allocation of resources to innovative …/

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investment strategies, and government investment in the knowledge base, state sponsored protection of markets and intellectual property rights, and state subsidies to support these business strategies. One cannot understand national economic development without understanding the role of the developmental state. At the same time, the specific agenda and ultimate success of the developmental state cannot be understood in abstraction from the dynamics of innovative enterprise. It is through the interaction of the innovative enterprise and the developmental state that entrepreneurial activity inserts itself into the economic system to contribute to the process of economic development.

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1 Introduction

In the 1950s and 1960s there was optimism within the economics profession that, armed with the theoretical and analytical tools that conventional economics had accumulated and refined, economists could help solve the problems of underdevelopment. Since then, the apparent failure of this endeavor has resulted in the marginalization of the field of development economics within the academic economics discipline. Why would we expect economists (many coming from poorer nations) whose education and training failed to equip them with an understanding of how the rich nations got rich to be able to devise policies for the poor nations to be able to become more like the rich nations? In my view, a basic intellectual challenge for those concerned with the poverty of nations was and remains that of coming to grips (finally) with the nature and causes of the wealth of the world's wealthier nations. As an economist, one might then be in a position to inform the poorer nations how they might achieve similar outcomes.

In keeping with this approach, this paper is organized around what I call 'the theory of innovative enterprise', the core perspective that I have derived from the historical and comparative study of the development of the advanced economies (for the methodological implications of this approach, see Lazonick 2002b, 2003b, and 2007a). In this paper I provide the basic outlines of the theory of innovative enterprise, with a particular focus on why and how it provides the essential analytical link between entrepreneurship and development. I define an entrepreneur simply as a person, or group of people, who starts a new firm. The question then is what contributions entrepreneurial activity makes to the development of the particular economy in which these firms have been founded. My basic argument is that one cannot make the link between entrepreneurship and economic development without a theory of the role of entrepreneurship in the innovating firm in which the three generic activities of the firm – strategy, organization and finance – shape the firm's ability to produce high quality, low cost goods and services.

In the theory of the innovating firm, the dynamic interaction of strategy, organization, and finance will determine whether the transformation of the firm's productive activities eventually results in 'innovation', defined as the generation of higher quality and/or lower cost products than were previously available at prevailing factor prices. This definition of innovation, I argue, is essential for taking us beyond the notion of innovation as a 'new idea', which in and of itself has no economic meaning, or even a failed 'new product', which may count as 'entrepreneurship' but not as 'innovation'. Thus defined, innovation provides the foundation for economic development because, adjusted for the quality of services, it makes it possible to get more output from a given amount of input.

The experiences of the advanced economies constitute the foundation for the elaboration of a relevant theory of innovative enterprise. As an empirical point of departure, Section 2 contrasts two very different worlds of entrepreneurship in development. In one world, powerful industrial enterprises emerge to drive the wealth of nations. In the other world, millions of very poor people engage in entrepreneurial activity to improve their economic conditions by making using of the limited resources at their disposal. One world of entrepreneurship entails innovative enterprise; the other entails the better and more complete employment of an individual's time. To understand

the problems and possibilities of economic development in both rich and poor nations, I argue, one must begin the analysis with the world of innovative enterprise.

Section 3 compares the theory of the innovating firm that is derived from the experiences of the advanced economies to the orthodox theory of the optimizing firm that is derived from what I have elsewhere call 'the myth of the market economy' (Lazonick 1991). In this context I also consider the contributions of evolutionary economists, generally inspired by the work of Schumpeter, to the theory of entrepreneurship and innovative enterprise. While the evolutionary perspective avoids the trap of placing the firm in equilibrium, and thus rejects the relevance of the neoclassical theory of the optimizing firm, the alternative that it presents generally lacks a conception of what I call the 'social conditions of innovative enterprise' that enable a firm to use strategy, organization, and finance to transform productive resources into higher quality lower costs goods and services. The evolutionary theory of the firm has taken the entry and exit of firms in an industry as a prime focus of its empirical research (for example running simulations of the process), but it has had little to say about the social conditions under which more rapid entry, and hence more abundant entrepreneurship, actually occurs.

Section 4 identifies the roles of entrepreneurship in new firm formation in terms of the types of strategy, organization, and finance that innovation requires. I argue that the entrepreneur is first and foremost a strategic actor; she takes the initiative to launch a new business where none had existed before. But the building of a business that can develop marketable products and generate revenues requires organization and finance. Those who start a new venture may not be well-suited to manage the labour and capital that is required to transform that venture into a going concern. Yet it is going concerns, not new ventures, that generate the revenues that permit the sustained employment of the labour force and the upgrading of existing products and processes. However important the entrepreneur may be for starting a new firm, therefore, the *disappearance* of the entrepreneur as a strategic actor is generally necessary for the continued growth of the firm. If and when the founder-entrepreneur remains in a position of strategic control as the firm becomes a successful going concern, she does so as manager of the firm's organization and capital, and not as an entrepreneur with an aptitude for creating new firms.

In Section 5 I argue that the industrial contexts in which entrepreneurship affects innovation are generally 'national', although within nations one often finds particular industrial districts such as 'Silicon Valley' or the 'Third Italy' in which entrepreneurship and innovation flourish. Notwithstanding the forces of globalization, it is generally recognized that national environments in which entrepreneurship and innovation may, or may not, thrive represent different 'varieties of capitalism' (Dore et al. 1999; Whitley 1999, 2002; Hall and Soskice 2001; Coates 2002; Lazonick 2007c). While entrepreneurship epitomizes the opportunities for the reallocation of a society's productive resources that open markets offer, they do so within national contexts in which *the state invariably plays a fundamental developmental role*. My argument, based on comparative-historical research, is that in *all* the advanced economies over the past century, *first and foremost the United States* where the ideology of 'free market' entrepreneurialism is most virulent, successful entrepreneurship in knowledge intensive industries has depended heavily upon a combination of (a) business allocation of resources to innovative investment strategies, and (b) government investment in the

knowledge base, state sponsored protection of markets and intellectual property rights, and (often extensive and persistent) state subsidies to support these business strategies.

One cannot understand national economic development without understanding the role of the developmental state. At the same time, the specific agenda and ultimate success of the developmental state cannot be understood in abstraction from the dynamics of innovative enterprise. Until one establishes the link between the innovative enterprise and the developmental state, I argue, one cannot begin to analyse in a systematic way how entrepreneurial activity inserts itself into the economic system to contribute to the process of economic development.

Scholars of the developmental state have tended to see it as first and foremost a Japanese, and by extension East Asian, phenomenon, while neglecting entirely the role of the developmental state in the United States, the world's largest and arguably the most entrepreneurial of the advanced economies. The reason for this failure lies, I would argue, in an implicit, and at times explicit, acceptance of the erroneous notion that the neoclassical theory of the market economy and the theory of the optimizing firm at its core represent an appropriate depiction of the way in which resources are allocated in an advanced economy such as the United States. If one wants to understand the relation between entrepreneurship and economic development, one must jettison this misguided preconception.

In the conclusion to this paper, I consider the implications of this perspective on entrepreneurship, innovation, and development for a research agenda on the role of entrepreneurship in economic development. This research agenda can be organized around the study of the employment, financial, and governance institutions that, as I argue in this paper, can provide essential support for entrepreneurship and innovation in the business sector. By the same token, I caution against a research agenda that takes entrepreneurship as its sole focus. Given the tendency in much of the literature on entrepreneurship to associate the phenomenon with free market individualism, there is a danger that in emphasizing the role of entrepreneurship in development, one will lose sight of the social conditions of innovative enterprise that form the essential link between the entrepreneurial individual and social progress.

2 Two worlds of entrepreneurship

In recent years development agencies as well as politicians have called for policies that can encourage 'entrepreneurship' in the poorest parts of the world with a view to closing the ever-growing gap between regions that have and regions that have not (UNDP 2004; World Bank 2004; Utomi 2006). The term 'entrepreneurship' is often used rather loosely to mean any instance in which an individual takes the initiative to do something new and constructive, whether in the sphere of business, government, or civil society. Nevertheless, there appears to be a general consensus that the type of entrepreneurship that makes a direct contribution to economic development is that which entails the founding of a new business enterprise. New firm formation, it is thought, tends to allocate the economy's resources to more productive uses than would otherwise have been the case.

Yet at any point in time, the vast majority of the business sector output of an economy derives from the investment and employment of established firms. As in the late 1990s dot.com binge in the advanced economies, the founding of new firms may actually waste an economy's productive resources rather than enlarge them. Under these circumstances, entrepreneurship may be 'value reducing', and through the manipulation of the stock market even 'value extracting', rather than 'value creating'. For entrepreneurship to contribute to economic development, a new firm must transform productive resources into *valued outputs* in ways that existing firms are unable or unwilling to do.

Within the history of economic thought, the idea that entrepreneurship can make important, and even fundamental, contributions to economic development can be found in its most explicit and forceful form in the early work, now almost a century old, of the Austrian economist, Joseph Schumpeter. The current interest among development practitioners in the promise of entrepreneurship, however, stems less from the rediscovery of Schumpeter and more from experiences in new firm formation at the extreme ends of the enormous global divide between the rich and the poor.

On the rich side of the entrepreneurial divide, there is the success of the United States in high-tech industries, most notably microelectronics, in which startups have played conspicuous roles. From the 1960s, a new breed of venture capitalist, many with prior managerial or technical experience in the semiconductor industry, backed so many microelectronics startups clustered in the region around Stanford University that by the early 1970s the district was dubbed 'Silicon Valley'. Innovation in semiconductors, and especially the development of the microprocessor – in effect a computer on a chip – created the basis for the emergence of the microcomputer industry from the late 1970s, which in turn resulted in the enormous growth of an installed base of powerful 'hosts' in homes and offices that made possible the Internet revolution of the 1990s. At each stage, entrepreneurs, often backed by venture capitalists, launched new firms, many of which failed but some of which drove the further evolution of the microelectronics revolution.

On the poor side of the entrepreneurial divide are the millions of new firms, typically consisting of only the entrepreneur herself, that have had access to microfinance provided by the Grameen bank in Bangladesh as well as its many imitators in poor countries around the world. Begun as an experiment in the last half of the 1970s, Grameen is a cooperative bank that makes collateral-less loans to the poor to enable them to employ themselves in income generating activities, most of which rely on their existing skills and physical resources. In 1979 Grameen lent US$180,000 to 2,200 bank members, 41 per cent of whom were women. In 2006 it lent US$928 million to 6.9 million members, 96 per cent of whom were women.[1] While there have been debates on the extent to which these loans contain subsidies as well as on the reasons why the loan recipients are almost all female (Wahid 1994; Hashemi et al. 1996; Mallick 2002; Hossain 2002), there is no doubt that the Grameen experiment in entrepreneurship has resulted in the productive use of previously underemployed human resources and augmented the standards of living of the borrowers.

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1 http://www.grameen-info.org/bank/hist2005$.html

The UNDP report, *Unleashing Entrepreneurship*, acknowledges the relevance of these two worlds of entrepreneurship (defined very broadly) when it states: 'Entrepreneurship encompasses the actions of small, informal, village based individuals as much as it does that of the managers and innovators in multinational corporations and large local companies' (UNDP 2004: Foreword). Nevertheless, the two extreme examples of entrepreneurship in Bangladesh and the United States that I have cited are worlds apart in terms of both context and impact. The challenge for the poorer countries is to find ways to start firms that can climb the 'value added' ladder, and make larger and more sustaining contributions to the development of the economy. From this perspective, it is reasonable to expect that policy makers who believe that entrepreneurship is important to economic development would want to have a thorough understanding of the developmental dynamics that have characterized a region grown rich like Silicon Valley. Indeed, given the importance of the microelectronics industry to the rapid growth of the newly industrializing economies of East Asia, the case of Silicon Valley would seem to be a logical starting point for a comparative-historical analysis of the role, spread, and impact of high-tech entrepreneurship around the world.

This 'high-road' approach for understanding the role that entrepreneurship might play in the economic development of poor nations is consistent with an intellectual position that I adopted over three decades ago when doing an economics PhD. My ultimate interest in studying economics was, as it remains, to understand how mass poverty might be eradicated on a global scale. The problem was that the more that I studied what the US economics profession called 'economics', the more I realized that, as a body, it clung to a conception of the way in which an advanced economy like the United States allocates resources that could not possibly form a foundation for investigating, let alone explaining, how the United States and other advanced economies had accumulated their considerable wealth.

The conventional wisdom is that the United States exemplifies an economy in which the market allocates resources to their best alternative uses. Yet such a perspective ignores the roles of corporations, often employing tens of thousands or even hundreds of thousands people, as well as governments, local, state, and federal, in the allocation of resources. Moreover, the allocations of productive resources by corporations and governments are central to the *development* of productive resources, rather than simply their utilization, thus determining the best alternative uses that, at any point in time, the market finds at hand (Lazonick 1991, 2003b).

3 Entrepreneurship and the theory of the innovating firm

3.1 The Schumpeterian insight

Almost a century ago, in *The Theory of Economic Development* (first published in German in 1911 and translated into English in 1934), Joseph Schumpeter argued that an analysis of the 'Circular Flow of Economic Life as Conditioned by Given Circumstances' could not explain economic development. By the 'Circular Flow' Schumpeter meant what we now call 'general equilibrium theory'; a theory of an economy in which market competition equilibrates the relation between supply and demand across a plethora of markets to achieve the 'optimal' allocation of resources in the economic system as a whole.

For anyone who has not studied economics, Schumpeter's argument may seem rather esoteric and academic. Even today, however, the policy pronouncements that most economists make on how to foster economic development derive from a 'theory of the market economy' that, as Schumpeter recognized, cannot explain the wealth of nations. Prevailing economic orthodoxy is that a capitalist economy is essentially a market economy in which, through the equilibration process, the allocation of resources across factor and product markets yields the best possible economic outcomes.

Schumpeter argued that economic development required the disruption of the general equilibrium of markets by entrepreneurial activity. In *The Theory of Economic Development*, he defined 'entrepreneurship' as the act of making 'new combinations' out of existing economic resources so that those economic resources yielded a larger amount of valued output for a given value of inputs. He called this productive transformation 'innovation'. In contrast to the 'Circular Flow', for Schumpeter innovation was the 'Fundamental Phenomenon of Economic Development'.

In the decades that followed the initial publication of *The Theory of Economic Development*, Schumpeter sought to understand how and under what conditions entrepreneurship that resulted in innovation actually occurred. What he noticed was that the transformation of entrepreneurship into innovation required business organization, often, and perhaps even generally, on a large scale. By the 1920s, the evidence for this proposition was already abundant for any observer of how the US economy operated. In the second half of the century, the extent to which big business dominated the advanced economies would be amply documented by business historians such as Chandler (1962, 1977, and 1990).

Influenced by his own understanding of the realities of the corporate economy, by the 1940s Schumpeter himself had taken definitive leave of his youthful conceptions of the innovative entrepreneur as an individual actor and innovation as simply 'new combinations' of existing resources. Rather, he saw that powerful business organizations both developed and utilized productive resources to create new technologies and access new markets. The creation of new technologies, moreover, destroyed the commercial viability of old technologies. In *Capitalism, Socialism, and Democracy*, first published in 1942, Schumpeter argued that the process of 'creative destruction' had become embodied in established corporations as 'technological "progress" tends, through systematization and rationalization of research and of management, to become more effective and sure footed', being 'the business of teams of trained specialists who turn out what is required and make it work in predictable ways' (Schumpeter 1950: 118, 132). From this perspective, entrepreneurship no longer drove the development of the economy. Its function has been replaced by what Nelson and Winter (1982: ch. 5), in drawing upon the insights in Schumpeter's later work, called 'organizational routines'.

The implications of these observations for understanding the process of economic development are profound. For economic development to occur, it is not enough for entrepreneurs to start new firms; some of those firms must grow over time. Moreover, not all new entrepreneurial firms grow in the same way and to the same extent. Any study of any industry in any period will show that firms that compete with one another even in the same locality will differ in their abilities to innovate and grow. Since innovation is essential for economic development, a theory of economic development requires not simply a 'theory of the firm' but a 'theory of the innovating firm'.

3.2 Theories of entrepreneurship

While there can be debate about what, in *The Theory of Economic Development*, Schumpeter meant by the 'new combinations' of productive resources that can result in innovation, it is clear that he viewed the entrepreneur as setting in motion an escape from the equilibrating forces of markets, thus opening up the possibility for economic development. The implication of Schumpeter's argument is that the market forces of supply and demand cannot develop the economy; they can only redistribute access to resources among buyers and sellers, none of whom as individuals can exercise control over the outcomes. In contrast, the entrepreneur can transform the way resources are allocated in the economy, and the way in which she does so can be the source of economic development.

Not all economists follow Schumpeter in viewing the entrepreneurial function as a disruption of the equilibration of market forces. In a manner consistent with the neoclassical theory of the market economy, so-called 'Austrian' economists such as Kirzner (1997) define the entrepreneur as one of the first to notice the appearance of disequilibrium conditions somewhere in the economic system. Hence he is among the first to reallocate resources from one use to another to take advantage of the existence of supernormal profits during the fleeting period during which these supernormal profits exist. His reallocation of resources to capture these supernormal profits contributes to the process of reducing them to normal levels, and when enough 'entrepreneurs' have discovered the disequilibrium opportunity, the consequent reallocation of resources re-establishes equilibrium conditions. In effect, the Kirznerian entrepreneur makes unstable markets more stable, thus reinforcing rather than disrupting Schumpeter's 'circular flow'.

As Austrian economists such as Boettke and Coyne (2003) recognize, the Kirznerian 'entrepreneur' is in effect an arbitrageur, in contrast to the Schumpeterian innovator. The entrepreneur as arbitrageur has little in common with the Schumpeterian entrepreneur whose actions create disequilibrium conditions, and who Schumpeter (1965) recognized could have motives other than profits and could even be a representative of the state. If one believes that the essence of superior economic performance is the allocation of resources through market processes that move prices toward their equilibrium levels, then one would be attracted to the Kirznerian conception of function of entrepreneurship. If, in contrast, one believes (as I would argue the history of capitalist development amply demonstrates) that economic development results from a combination of business and government investments that disrupt market 'equilibrium', with (somewhat ironically) well-functioning markets as an *outcome*, then one would be attracted to the Schumpeterian conception of the function of entrepreneurship (see Lazonick 2003b for a statement of this argument).

Boettke and Coyne (2003) contend that entrepreneurs, be they Kirznerian arbitrageurs or Schumpeterian innovators, are omnipresent in all societies; they embody the human quest for individual action and expression. In addition, they draw on the work of Brenner (1985) to argue that entrepreneurship can also be conceived as 'betting on ideas' They assume that all three forms of entrepreneurship – innovation, arbitrage, and bets – can, *if activated*, enhance the performance of the economy. For Boettke and Coyne, it is national institutions that determine whether or not this latent, omnipresent entrepreneurship is activated. If a society ensures that the appropriate national institutions are in place, entrepreneurship, of whatever variety, will take care of itself.

As Boettke and Coyne (2003: 13) put it: 'Given that the entrepreneur is the catalyst of economic growth, any theory of economic development must consider the deeper issues that effect the entrepreneurial aspect of human action. These issues include a broad range of institutions including political, legal and sociological considerations such as culture, ideology, values and preferences.' They go on to argue, in line with the well-known writings of de Soto (2000), that the 'core' institutions that encourage entrepreneurship are well-defined property rights and the rule of law. As Boettke and Coyne (2003: 20) conclude:

> Historically, those countries that have well-defined property rights and a strong rule of law also have a high growth rate. In considering developing countries, those that have adopted these core institutions as well as others that stem from it – freedom of choice, predictable government activity, rules conducive to market and firm development, freedom of contract and exchange, etc. – have also grown at a faster rate as compared to their counterparts which have adopted different institutions. The adoption of these institutions has provided an incentive structure which encourages the entrepreneurial aspect of human action, and hence continued economic progress.

For constructing a research agenda on the relationship between entrepreneurship and development, there are many problems with this 'new institutional' approach. First, one would be hard put to demonstrate that well-defined property rights and rule of law are not more the effect than the cause of economic development – one need only think of the 'Wild West' of the United States in the late nineteenth and early twentieth centuries, or the continuing debate that goes on within advanced economies of the definition of intellectual property rights.

Second, the notion that well-defined property rights protect the individual, and thereby encourage individual entrepreneurship, is open to question. There is, for example, a very important literature based on the nineteenth-century experience of the United States that shows how laws related to property rights were transformed to enable corporations to develop the economy by superseding the pre-existing property rights of individuals (see Horwitz 1977; Steinberg 1991). When one recognizes the central importance of the business corporation in the economy, one must also recognize that the relation between the collective rights of the corporation and the individual rights of its employees, shareholders, suppliers, and customers is constantly evolving and differs dramatically even across the advanced economies. The protection of corporate property rights may have been more important than the protection of individual property rights in the development of the most advanced economies.

Third, the willingness to simply argue that all forms of entrepreneurship – that is, individual initiative – result in economic development begs the questions of what types of entrepreneurship have the greatest and most sustainable impact on raising the living standards of the population. Following the distinction by Baumol (1990) between productive and unproductive entrepreneurship, one might classify arbitrage and betting as representing the unproductive (or rent seeking) side of entrepreneurial activity and innovation as representing the productive (or value creating) side. Having found important distinctions among the types of 'entrepreneurial' activity in the literature, Boettke and Coyne make no effort to analyse what contributions innovation, arbitrage, and bets actually make to the process of economic growth. Only innovation, as I have

defined it, results in higher quality, lower cost products that, depending on a society's institutions, can potentially make everyone better off. To understand the role of entrepreneurship in economic development, there is a need to understand what in this essay I call the 'social conditions of innovative enterprise'.

In arguing that well-defined property rights and rule of law are the foundations of economic development because they create incentives for entrepreneurship, Boettke and Coyne (2003: 15) refer to the work of Olson (1996) to posit that 'it is widely agreed that the incentive structure influences the action of economic agents', and that this purported consensus 'allows us to rule out such considerations as the availability of technological knowledge, the population level, migration, etc. as factors which can serve to explain the differences in wealth across countries.' For anyone who has studied the processes of comparative economic development, this belief in the power of 'unleashed entrepreneurship' as the source of the wealth of nations represents the ideology of individualism run amok. Contrary to the undocumented assertion of these two authors, not all nations have access to the same technological knowledge, the ratio of population to available productive resources influences the development process, and internal and transnational migration change not only the population ratio but also the mix of the population with education, specialized knowledge, and work experience (see for example Lazonick 2006b). Within the economy, moreover, entrepreneurs, properly defined, do not accomplish their own work as individuals, but rather as leaders of business organizations that require complex hierarchical and functional divisions of labour to generate goods and services that are valued on the market. An essential step in linking entrepreneurship to development is to show the relation of entrepreneurship to the business enterprise.

3.3 Entrepreneurship and theories of the firm

As we have seen, in *The Theory of Economic Development*, Schumpeter began his exploration of the development process by focusing on the role of the individual entrepreneur. After several decades of study, however, he came to recognize the centrality of the large scale business enterprise. As captured in the works of Penrose (1959) and Chandler (1962), by the 1950s the large industrial corporation had come to dominate the US economy and its multinational operations had spread across the globe. For those such as Chandler and Penrose who studied the role of the business enterprise in economic development, the focus was on how large business enterprises could be managed so that they would continue to grow rather than on how entrepreneurs could be induced to start new firms.

Chandler's work is important not because it was Schumpeterian (although Chandler did his early work in the 1950s at the Schumpeter-inspired Harvard Research Center in Entrepreneurial History) but because it focused on the role of the firm in the allocation of resources in the economy and on the relation between strategy and structure in the growth of the firm (Chandler 1962: 1977). Sociological in its orientation (having been influenced by the structural-functionalist approach of Talcott Parsons), Chandler's work made business history relevant and accessible to the social sciences, demonstrating as it did the powerful generalizations and hypotheses that could be derived from a combination of primary research and historical synthesis. At the same time, by focusing on the growth of the major firms in the rise of the world's most powerful economy, Chandler's business history cried out for a theory of innovative enterprise.

Key elements of that theory, rooted in the same history of US managerial enterprise that was the focus of Chandler's studies, can be found in the work of Penrose (see especially Penrose 1959, 1960; see also Lazonick 2002a, 2002b). An economist, Penrose did pioneering work on the evolution of the international patent system for her Johns Hopkins PhD thesis, before undertaking the work that led to her 1959 book, *The Theory of the Growth of the Firm*. Like Chandler, Penrose was not overly influenced by the work of Schumpeter. But more than any other economist of the post-Schumpeter generation, Penrose's work elaborated the foundations of a theory of innovative enterprise.

In *The Theory of the Growth of the Firm*, Penrose conceptualized the modern corporate enterprise as an organization that administers a collection of human and physical resources. People contribute labour services to the firm, not merely as individuals, but as members of teams who engage in learning about how to make best use of the firm's productive resources – including their own. This learning is organizational; it cannot be done all alone, and hence is collective, and it cannot be done all at once, and hence is cumulative (see Best 1990: 125).

At any point in time, this organizational learning endows the firm with experience that gives it productive opportunities unavailable to other firms, even in the same industry, that have not accumulated the same experience. The accumulation of innovative experience enables the firm to overcome the 'managerial limit' that in the neoclassical theory of the optimizing firm causes the onset of increasing costs and constrains the growth of the firm. The innovating firm can transfer and reshape its existing productive resources to take advantage of new market opportunities. Each move into a new product market enables the firm to utilize unused productive services accumulated through the process of organizational learning. These unused productive services can provide a foundation for the growth of the firm, through both in house complementary investments in new product development and the acquisition of other firms that have already developed complementary productive resources.

The importance and persistence of the large industrial corporation in the post Second World War decades led Nelson and Winter (1982) to make Schumpeter's argument concerning the routinization of corporate R&D central to their 1982 treatise, *An Evolutionary Theory of Economic Change*. Labeling their economic theory neo-Schumpeterian, Nelson and Winter focused on the need for a theory of the firm that went beyond the optimization principle of neoclassical orthodoxy, and focused on the interrelated concepts of routines and tacit knowledge as basic explanations of the organizational capabilities of firms.

This approach contained no theory of entrepreneurship; indeed there is no reference to 'entrepreneurship' in the index of *An Evolutionary Theory of Economic Change*. In the summary of their chapter on 'Generating and Limiting Competition', Nelson and Winter recognize that, in terms of their model, 'things would clearly be different if entrants came in a large scale, as technological leaders, and motivated by subtle, long run strategic calculations' (Nelson and Winter 1982: 328). Subsequently, based on simulations in which entry of new firms play a central role, Nelson and Winter and their colleagues have developed a 'history friendly' model of industrial evolution (Malerba et al. 1999; Malerba and Orsenigo 2002), while Malerba and Orsenigo have done extensive statistical work on entry and exit in industry in which new products and processes create opportunities for new firm formation (see, for example, Malerba and Orsenigo 1997).

This line of research generally views the process of new firm formation as the result of new technological opportunities, but provides no analysis of the role of entrepreneurship in taking advantage of these opportunities (for a recent summary of this perspective, see Malerba 2006). An exception among those who build directly on the work of Nelson and Winter can be found in the work of Klepper (2001) that explores the conditions under which employees leave established companies to do entrepreneurial startups.

Especially in subsequent collaborative projects co-directed by Nelson, the evolutionary approach, shed of its original biological crutches (market competition as a 'selection process' and organizational routines as 'genes'), has fostered considerable work by economists and other social scientists on the organization and dynamics of innovative enterprise (see Nelson 1993; Mowery and Nelson 1999; Fagerberg et al. 2004). In 'Why Do Firms Differ, and How Does It Matter?' Nelson (1991: 72) articulated the need for a theory of organizational capabilities as a basis for a theory of innovative enterprise: 'I want to put forth the argument that it is organizational differences, especially differences in abilities to generate and gain from innovation, rather than differences in command over particular technologies, that are the source of durable, not easily imitable, differences among firms. Particular technologies are much easier to understand, and imitate, than broader firm dynamic capabilities.' He goes on to say that 'the "dynamic capabilities" view of firms being developed by scholars in the strategy field can be seen to be important not only as a guide to management, but also as the basis for a serious theory of the firm in economics.'

The most widely cited statement of this perspective is that of Teece et al., in an article published in the Strategic Management Journal in 1997. They contrast the dynamic capabilities approach with a perspective dominant in the management literature on 'strategizing' that entails 'engaging in business conduct that keeps competitors off balance, raises rival's costs, and excludes new entrants' and that conceives of 'rents' as 'flow[ing] from privileged product market positions' (Teece et al. 1997: 509). Teece et al. (1997: 517) see the distinctiveness of firms as opposed to markets as residing in the capabilities in 'organizing and getting things done' in ways that 'cannot be accomplished merely by using the price system to coordinate activity. The very essence of capabilities/competences is that they cannot be readily assembled through markets.'

'Organizational processes', they argue, 'often display high levels of coherence, and when they do, replication may be difficult because it requires systemic changes throughout the organization and also among interorganizational linkages, which may be hard to effectuate.' They liken 'coherence' to Nelson and Winter's notion of 'routines', with the caveat that 'the routines concept is a little too amorphous to properly capture the congruence among processes and between processes and incentives that we have in mind.' Teece et al. (1997: 520) stress the importance of learning processes that are 'intrinsically social and collective' and argue that the 'concept of dynamic capabilities as a coordinative management process opens the door to the potential for interorganizational learning.' Strategic change is generally incremental, as new capabilities have to build cumulatively on the capabilities previously put in place. From the dynamic capabilities perspective, 'strategy involves choosing among and committing to long term paths or trajectories of competence development' (Teece et al. 1997: 524–29).

Given the need for long term paths of competence development, what role does entrepreneurship play in the process? This question can only be answered by means of

an analysis of the relation between established corporations and entrepreneurial startups in particular industries (an exemplary study is Chesbrough 2003). For example, in a recent book on the biotechnology industry, Pisano (2006) has argued that, given the need for collective and cumulative learning over very long periods of time in order to generate a commercializable biotechnology product, the US industry has been afflicted by *too much entrepreneurship*, due to an excess supply of venture capital. He thus raises the important question of when and under which conditions entrepreneurship contributes to innovative enterprise. To answer this question, we need to consider the role of the entrepreneur in what I call the 'innovating firm'.

3.4 Innovating versus optimizing firms

An analysis of the contribution of entrepreneurship to innovation and development requires a theory of innovative enterprise. We can derive an understanding of the key characteristics of the innovating firm by comparing it to the 'theory of the optimizing firm' that during the first half of the twentieth century emerged out of the theory of the market economy. The theory of the optimizing firm remains the only theory of the firm in almost all economics textbooks, and one which is engrained in the thinking of 'well-trained' economists.[2] Then, given our identification of the activities in which an innovating firm must engage, we can ask what roles 'entrepreneurship' has played in this process. To illustrate these roles, I draw mainly on the experience of the United States, the world's largest economy in which big business and small startups are both prominent.

A firm seeks to transform productive resources into goods and services that can be sold to generate revenues. A theory of the firm, therefore, must, at a minimum, provide explanations for how this productive transformation occurs and how revenues are obtained. These explanations must focus on three generic activities in which the business enterprise engages: strategy, organization, and finance. *Strategy* allocates resources to investments in developing human and physical capabilities that, it is hoped, will enable the firm to compete for chosen product markets. *Organization* transforms technologies and accesses markets, and thereby develops and utilizes the value creating capabilities of these resources to generate products that buyers want at prices that they are willing to pay. *Finance* sustains the process of developing technologies and accessing markets from the time at which investments in productive resources are made to the time at which financial returns are generated through the sale of products.

The neoclassical theory of the optimizing firm (see the left hand side of Figure 1) trivializes the content of these three generic activities. In neoclassical theory, the rule of profit maximization, imposed on the firm by given technological and market

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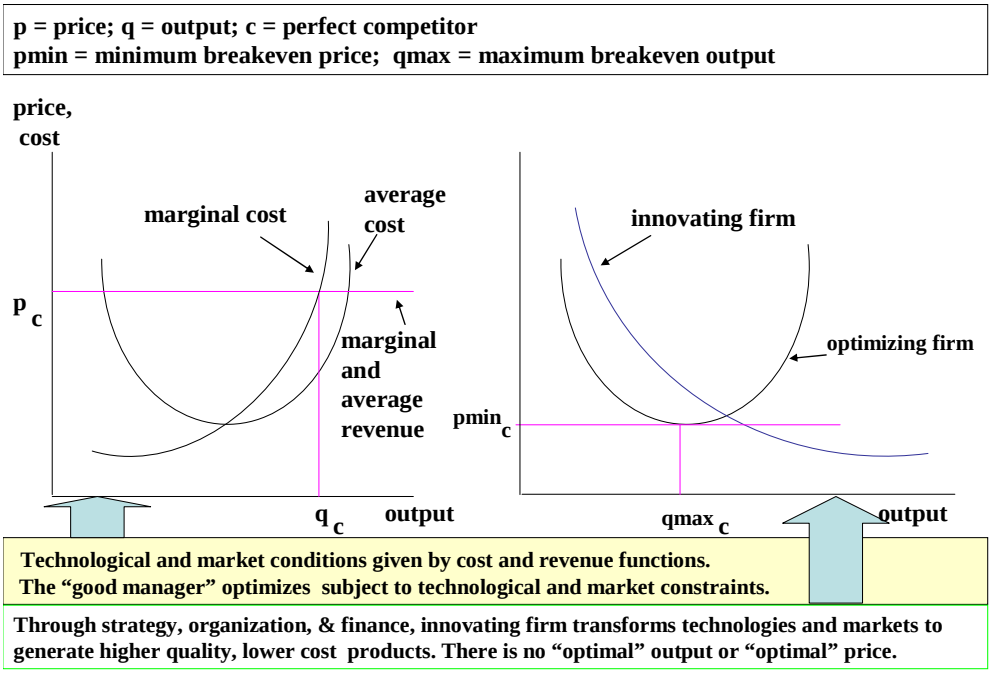
2 As Caves (1980: 88) put it in a survey article on 'industrial organization, corporate strategy and structure': 'If one accepts the weak postulate that the firm is a purposive organization maximizing some objective function, it follows that its strategic and structural choice represents a constrained optimization problem. My reading is that students of business organization with disciplinary bases outside of economics would accept that proposition but have lacked the tools to follow its blueprint. Constrained-maximization problems are mother's milk to the well-trained economist.'

Figure 1 Comparing the innovating and optimizing firm



constraints, determines the firm's strategy about the industry in which the firm should compete and the quantity of output that the firm should produce. Given the industry in which the firm has invested, exogenous production functions and factor prices determine the organization of the firm. Financing the transformation of productive resources into revenue generating products is non-problematic because the theory assumes that, at each and every point in time, the firm can borrow capital at the prevailing market rate and can sell all of the output that maximizes its profits, covering the cost of capital.

While the neoclassical theory of the firm trivializes the content of strategy, organization, and finance as business activities, the particular formulation of the theory from the 1920s by the followers of the pre-eminent British economist, Alfred Marshall, embodied a number of realistic assumptions about the factors that influence the relation between the costs of production and the amount of output produced. These realistic assumptions have made the theory credible as a depiction of the way in which an actual firm operates. Analytically, these assumptions have provided the basis for a reasoned account of why the firm might have a U-shaped cost curve that, through the profit maximization rule, enables it to choose an optimal level of output.

The problem is, however, that the *optimizing* firm of post-Marshallian theory is not an *innovating* firm; indeed it can be characterized as a *non-innovating* firm. In terms of strategy, the theory of the optimizing firm posits that an 'entrepreneur' chooses the industry in which she wants to compete by allocating resources to any industry in which, because of the exogenous appearance of a disequilibrium condition, there are supernormal profits to be made. The disequilibrium condition disappears as entrepreneurs reallocate resources to this particular industry by setting up new firms. As long as equilibrium conditions persist across all industries, there will be no incentive for the entrepreneur to shift resources from one industry to another.

Underlying this allocative mechanism are two assumptions of the neoclassical theory of the firm that limit its ability to understand innovative enterprise. First, the neoclassical theory assumes that *the entrepreneur plays no role in creating the disequilibrium condition* that triggers the reallocation of resources from one industry to another. In contrast, in the theory of the innovating firm, by investing in 'new combinations', entrepreneurs create new profitable opportunities, and thereby disrupt equilibrium conditions. Second, the neoclassical theory assumes that *the entrepreneur requires no special expertise to compete in one industry rather than another*. All that is required of the entrepreneur is that she follows the principle of profit maximization in the choice of industry in which to compete. In the theory of the innovating firm, in contrast, the entrepreneur's specialized knowledge of the industry in which she chooses to compete is of utmost importance for her firm's ability to be innovative in that industry.

Once the industry has been chosen, the neoclassical theory assumes that there are certain fixed costs, exogenously determined by existing technology and prevailing factor prices, that must be incurred by each and every firm that chooses to compete in the industry. These fixed costs are typically attributed to lumpy investments in plant and equipment, although it is also sometimes recognized that the entrepreneur's salary represents an element of fixed costs. These costs are fixed because they are incurred even if the firm produces no output. As the firm expands its output, the average cost curve slopes downward as fixed costs are spread over a larger volume of output.

The limiting assumption here is that the level of fixed costs is given to any entrepreneur who enters the industry. In the theory of the optimizing firm, *the 'entrepreneur' does not choose the firm's level of fixed costs and the particular productive capabilities embodied in them as part of his firm's investment strategy*. In the theory of the innovating firm, the entrepreneur strategically chooses to make investments that are intended to endow the firm with distinctive productive capabilities compared with its competitors in the industry (see the right hand side of Figure 1). These strategic decisions, potentially unique to each entrepreneurial firm, determine the innovating firm's level of fixed costs.

Given the firm's fixed costs, the 'optimizing entrepreneur' (an oxymoronic term) purchases that quantity of complementary variable inputs at prevailing factor prices that are dictated by the technological requirements of the amount of output at which profits are maximized. Thus variable costs per unit of output are added to the fixed costs per unit of output to yield total unit costs, with the average cost curve mapping these total unit costs for different levels of output. If variable costs were to remain constant as output expands, the average cost curve would slope downwards continuously (although at a declining rate) as fixed costs are spread over more units of output.

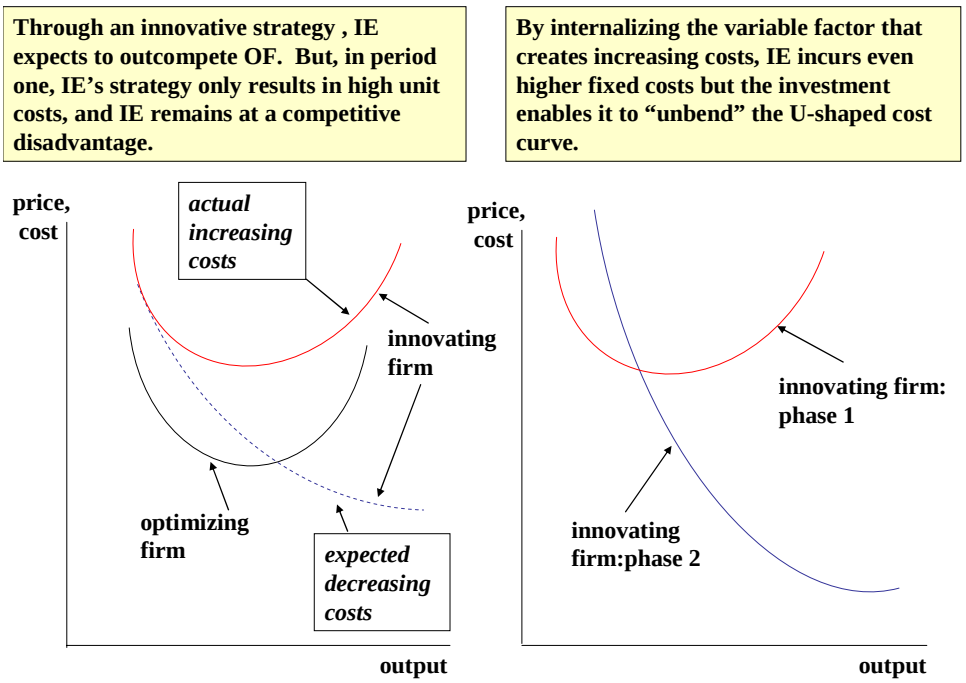
At this point, however, the neoclassical theory makes a critical assumption that causes the average cost curve to change direction and slope upwards, thus yielding the well-known U-shaped cost curve. The assumption is that the addition of variable factors of production to the firm's fixed factors of production results in a declining average productivity of these combined factors (that is, the firm's technology, which is also the industry's technology). In deriving the U-shaped cost curve, neoclassical theorists have given two quite plausible reasons for the decline in average productivity as output expands. Both reasons assume that the key variable factor is labour. One reason is that as more variable factors are added to the fixed factors, increasingly crowded factory conditions reduce the productivity of each variable factor as, for example, workers

continuously crowd one other. The other reason is that as more workers are added to the production process, the entrepreneur, as the fixed factor whose role it is to organize productive activities, experiences a 'control loss' because of the increasing number of workers that he has to supervise and monitor.

Hence organization – in this case the relation between the entrepreneur as manager and the work force that he employs – becomes central to the neoclassical theory of the firm. Within the theory of the optimizing firm, the constraining assumption is that *the so-called entrepreneur passively accepts this condition of increasing costs, and optimizes subject to it as a constraint*. In sharp contrast, in the theory of the innovating firm, the experience of increasing costs, as shown on the left hand side of Figure 2, provides the firm's strategic decision makers with an understanding of the limits of the *initial* investment strategy, and with that information they make additional new investments for the strategic purpose of *taking control* of the variable factor that was the source of increasing costs.[3]

The entrepreneur of an innovating firm would not take a condition of overcrowding or control loss that results in increasing costs as a 'given constraint', but rather would make investments in organization and technology to change this condition. In effect, for the sake of improving its capability of developing and utilizing productive resources, the firm makes new *strategic* investments that transform variable costs into fixed costs, in effect transforming external market relations into internal organizational relations. These new strategic investments stack new fixed costs on top of previously incurred

Figure 2 Innovative strategy and the reshaping of the cost curve



3 For an elaboration of this argument, see Lazonick (1991: ch. 3, and 1993).

fixed costs, thus increasing the challenge that faces the firm of transforming high fixed costs into low unit costs.

The recognition that the firm has fixed costs creates a role for finance in the theory of the optimizing firm. A firm needs to finance fixed cost investments because, by definition, the returns from these investments are generated over time. The theory of the optimizing firm posits that, at any given point in time, the firm can sell all the output that it wants according to a known industry demand schedule. Hence, in theory, there are no risks entailed in the financing of investments over the period of time that it takes to amortize these investments. The cost of capital is built into the firm's cost structure, and simply reflects the market price of finance.

Note that *fixed* costs are not *sunk* costs. Neoclassical theorists have recognized the adjustment problem that faces an industry when there is an exogenous decline in industry demand that results in overcapacity. With market prices depressed, some firms should exit the industry. But given the assumption that all firms in the industry have identical cost structures, there is no reason why some firms would drop out of the industry, leaving other firms to enjoy the restoration of 'normal' profits. Rather all firms in the industry, viewing their fixed costs as sunk costs, continue to produce at the profit maximizing level as long as the market price at least enables them to cover their variable costs. Under such conditions of 'cut-throat competition', firms in effect live off their existing 'sunk cost' investments while they lack the prospective returns to justify the financing of new 'fixed cost' investments.[4]

In the theory of the innovating firm, the uncertainty inherent in fixed costs is central to the analysis rather than, as in the theory of the optimizing firm, entering as an *ad hoc* concession to reality. The theory of the innovating firm assumes that the investments that the firm makes must be developed and utilized over time, as the firm transforms technologies and accesses markets, before returns from those investments can be generated, or indeed before the rate of return can even be known. The problem is not, as in the theory of the optimizing firm, whether the prevailing return on investment provided by existing technological and market conditions will continue *in the future*. Since the return on investments depends on the extent of the market that the innovating firm actually attains, a return on investment *does not even prevail in the present*; that is, at the time when the investments in innovation are made.

By definition, investments in innovation are made in the face of uncertainties concerning prospective returns. Any entrepreneur who allocates resources to an innovative strategy faces three types of uncertainty: technological, market, and competitive. Technological uncertainty exists because the firm may be incapable of developing the higher quality processes and products envisaged in its innovative investment strategy; if one already knew how to generate a new product or process at the outset of the investment, it would not be innovation. Market uncertainty exists because, even if the firm is successful in its development effort, future reductions in product prices and increases in factor prices may lower the returns that can be generated by the investments. Moreover, the innovative enterprise must access a large enough extent of the product market to transform the fixed costs of developing a new technology into low unit costs. Like transforming technology, accessing the market is an

4 See Reynolds (1940) for a classic statement of the problem of cut-throat competition.

integral part of the innovation process, and, at the time when resources are committed to an innovative strategy, it is impossible to be certain, even probabilistically, about what extent of the market will be accessed. Finally, even if a firm overcomes technological and market uncertainty, it still faces competitive uncertainty: the possibility that an innovative competitor will have invested in a strategy that generates an even higher quality, lower cost product.

The optimizing firm may calculate, on the basis of prior experience, the risk of a deterioration of current market conditions, but it has no way of contemplating, let alone calculating, the uncertainty of returns for conditions of supply and demand that, because innovation is involved, have yet to emerge. The fact, moreover, that the optimizing firm will only finance investments for which an adequate return already exists creates an opportunity for the innovating firm to make innovative investments that, if successful, can enable it to outcompete optimizing firms. Indeed, in the future optimizing firms may find that the cause of the 'poor market conditions' that they face is the result of not an exogenous shift in the industry demand curve but rather competition from innovating firms that have gained competitive advantage while their own managers happily optimized (as indeed the economics textbooks instructed them to do) subject to given technological and market constraints.

3.5 The innovation process

The task for a theory of innovative enterprise, therefore, is to explain how, by generating output that is higher quality and/or lower cost, a particular enterprise can differentiate itself from its competitors and over time gain a disproportionate share of the market in its industry. Unlike the optimizing firm, the innovating firm does not take as given the fixed costs of participating in the industry. Rather, given prevailing factor prices, the level of fixed costs that it incurs reflects its innovative strategy. Neither indivisible technology nor the 'entrepreneur' as a fixed factor (typical assumptions in the neoclassical theory of the optimizing firm) dictates this 'fixed cost' strategy. An innovative strategy, with its fixed costs, results from the assessment by the firm's strategic decision makers of the quality and quantity of productive resources in which the firm must invest to *develop* higher quality processes and products than those previously available or that may be developed by competitors. It is this development of productive resources internal to the enterprise that creates the *potential* for an enterprise that pursues an innovative strategy to gain a sustained advantage over its competitors and emerge as dominant in its industry.

Such development of productive resources, when successful, becomes embodied in products, processes, and people with superior productive capabilities than those that had previously existed. But the high fixed costs that such investments entail mean that in and of themselves these investments place the firm at a competitive *disadvantage* until such time that, by developing and utilizing the productive resources in which it has invested, it can transform technologies and access markets to generate sufficient financial returns. An innovative strategy that can enable the firm to develop superior productive capabilities over time may place that firm at a cost disadvantage at a point in time because such strategies tend to entail higher fixed costs than the fixed costs incurred by rivals that choose to optimize subject to given constraints.

For a given level of factor prices, these higher fixed costs derive from the *size* and *duration* of the innovative investment strategy. Innovative strategies will entail higher fixed costs than those incurred by the optimizing firm if the innovation process requires the *simultaneous development* of productive resources across a broader and deeper range of integrated activities than those undertaken by the optimizing firm. But in addition to, and generally independent of, the size of the innovative investment strategy at a point in time, high fixed costs will be incurred because of the duration of time that is required to develop productive resources until they result in products that are sufficiently high quality and low cost to generate returns. If the size of investments in physical capital tends to increase the fixed costs of an innovative strategy, so too does the duration of the investment in an organization of people who can engage in the collective and cumulative – or organizational – learning that is, as I discuss below, the central characteristic of the innovation process.

The high fixed costs of an innovative strategy create the need for the firm to attain a high level of *utilization* of the productive resources that it has developed. As in the neoclassical theory of the optimizing firm, given the productive capabilities that it has developed, the innovating firm may experience increasing costs because of the problem of maintaining the productivity of variable inputs as it employs larger quantities of these inputs in the production process. But rather than, as in the case of the optimizing firm, take increasing costs as a given constraint, the innovating firm will attempt to transform its access to high-quality productive resources at high levels of output. To do so, it invests in the *development* of the productive resource, the *utilization* of which as a variable input has become a source of increasing costs (see Figure 2).

The development of the productive resource adds to the fixed costs of the innovative strategy. Previously this productive resource was utilized as a variable factor that could be purchased incrementally at the going factor price on the market as extra units of the input were needed to expand output. Having added to its fixed costs in order to overcome the constraint on enterprise expansion posed by increasing variable costs, the innovating firm is then under even more pressure to expand its share of the market in order to transform high fixed costs into low unit costs. As, through the development and utilization of productive resources, the innovating firm succeeds in this transformation, it in effect 'unbends' the U-shaped cost curve that the optimizing firm takes as given (see Figure 2).[5] By shaping, and reshaping, the cost curve in this way, the innovating firm creates the possibility of securing sustained competitive advantage over its rivals.

4 The entrepreneurial functions in the innovating firm

What role, then, does entrepreneurship play in the innovation process, and what are the implications for understanding how the entrepreneurial function is performed? We can provide some answers to these questions by considering the role of the entrepreneur in the performance of the firm's three generic activities: strategy, organization, and finance. We want to understand the ability and incentive of the entrepreneur to engage in

5 For a more complete theoretical elaboration of this process of sustained innovative transformation, see Lazonick (2007a).

a) the exercise of *strategic control* by allocating resources to an innovative investment strategy;

b) the management of *organizational integration* by creating incentives for the individuals who participate in the firm's hierarchical and functional division of labour to supply their skills and efforts to the innovation process;

c) the mobilization of *financial commitment* by assuring that the firm has a continuous supply of financial resources available to sustain the innovation process until it can generate financial returns.

If it were the case that the entrepreneur could generate innovation as *an isolated individual*, then she could make the strategic decision to allocate resources to the innovation process, organize her own skill and effort to engage in the learning that is the essence of innovation, and commit her own financial resources to the sustaining the innovation process until she generated a higher quality, lower cost product that could generate financial returns. Isolated innovation is, however, rarely the case. In general, the entrepreneur must secure the cooperation of other people who possess specialized labour and sufficient finance in order to transform strategic investment decisions into innovative products. In doing so, as we shall see, the entrepreneur typically must share strategic control.

The entrepreneur is first and foremost a strategist. She makes strategic investment decisions depending on the particular product market in which she wishes to compete and the particular productive activities that, in her view, will enable her firm to generate competitive products. As we have seen, these investment decisions must be made in the face of technological, market, and competitive uncertainty. Research on entrepreneurial startups in the same industry segment in the same time period shows that the investment strategies of these firms often differ.[6]

While we can expect that an element of inexplicable 'luck' will enter into the success or failure of entrepreneurship, research also shows that the successful entrepreneur is a person who confronts uncertainty with considerable career experience in and knowledge of a segment of an industry to which she has in essence dedicated her life. Studies of what Gompers et al. (2005) have called 'entrepreneurial spawning' show unequivocally that entrepreneurial activity in high-tech sectors is knowledge intensive and industry specific (see also Shane 2000; Klepper 2001; Feldman et al. 2005; Porter et al. 2005). The relevance of the career paths of entrepreneurs for developing economies is also evident in the work of Saxenian (2006) on the 'brain circulation' of Taiwanese, Chinese, and Indian scientists, engineers, and managers who have returned to their homelands to found new high-tech firms after gaining graduate education and (often substantial) work experience in the United States. Depending on the locus of learning that is relevant to a particular industry as well as the stage of development of that

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6 The best comparative study of which I am aware is that of Bassett (2002: 231–239) which compares the investment strategy of Intel, founded in Silicon Valley in 1968, with that a semiconductor firm called Cogar that was set up at the same time in New York State by engineers who had worked for IBM. Cogar's investment strategy was radically different from that of Intel. As another example, in the early 1980s most semiconductor startups that produced logic chips invested in their own fabrication facilities, while a few startups pursued a 'fabless' strategy (see Lazonick 2006a).

industry, its entrepreneurs may have had prior career experience in established companies, other young companies, research institutes, or academia. The important point is that the career paths of entrepreneurs who populate an industry are not random, and hence, relative to the general population, their capacity to confront and overcome uncertainty is not simply a matter of luck.

Within a particular industry in a particular time and place, the vast majority of people whose career paths could lead them to engage in entrepreneurship do not aspire to that role. What distinguishes the psychological makeup of the risk taking entrepreneur from others equally well-placed who do not take up the challenge is probably the most difficult of the determinants of entrepreneurship to document empirically (Shane 2003: ch. 5). Insofar as there is a 'classical' debate in the literature on entrepreneurship, it is whether it is the psychological traits of the entrepreneur or objective conditions, career experience, and one's location in time and place that are more important in determining the quantity and quality of entrepreneurship that is forthcoming. In a far-reaching survey of 'the sociology of entrepreneurship', in which entrepreneurship is defined as 'the creation of new organizations', Thornton (1999: 19) argues that '[u]ntil recently, the supply side perspective, which focuses on the individual traits of entrepreneurs, has been the dominant school of research [whereas] [n]ewer work from the demand side perspective has focused on…the context within which entrepreneurship occurs.'

In a theory of innovative enterprise, the key 'supply side' issue is the capability of the entrepreneur to go beyond the launching of a new venture to contribute to its transformation into a going concern. For a person who makes the strategic decision to become an entrepreneur by founding an innovating firm, the test of her suitability for an ongoing role in the innovation process will come when she tries to build an organization to develop products and processes that will, she hopes, become sources of the firm's innovative success. Unless the new firm is a one-person consultancy, the entrepreneur will find herself playing the role of organizer of other people's labour, and even a very small firm in a knowledge intensive industry can grow quickly to, say, 30 employees. In the innovating firm, moreover, the organizational challenge is *not* one of keeping easily replaceable employees at work on routine tasks. The innovating firm makes strategic investments in the employment of a significant number of highly capable specialists, who typically have attractive alternative opportunities but whose labour services must be integrated into the firm's collective and cumulative learning process in order the generate innovation.[7]

Some entrepreneurs may have an aptitude for running a learning organization, especially those who have had experience as managers in established companies. In high-tech industries however, it is often the case that the innovating firm will employ professional managers with experience and accomplishments in the industry concerned to run its day-to-day operations. Since, as illustrated in Figure 2 above, the success of organizational learning generally depends on an ongoing process of strategic investment as old problems are solved and new problems are discovered, it is typically necessary

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7 Note that, notwithstanding the standard accounting practice that treats all direct labour costs as current expenses, an investment in organizational learning, for which the firm incurs costs now with a view to generating revenues at a later date, represents fixed costs from an economic point of view. The correct accounting practice would entail recording 'human capital' as an asset on the balance sheet, but in a modern society with free wage-labour, a firm cannot own human capital.

for the hired managers to be included, along with the entrepreneur, in the strategic decision making process. Yet, often reluctant to share strategic control of the firms that they have founded, many entrepreneurs resist employing professional managers, a stance that almost invariably is detrimental to the innovation process.

Also detrimental to the innovation process is the labour market mobility of the specialized labour that the firm employs. Especially in a new venture that, with a relatively small number of people, is striving to integrate the specialized capabilities of highly qualified individuals into a collective and cumulative learning process, the departure of even a few employees can have a devastating impact. The problem of highly mobile labour is particularly the case in US high-tech districts such as Silicon Valley or Boston's Route 128 where, especially in a boom, large numbers of startups spring up in close proximity to existing firms in the industry to try to take advantage of the entrepreneurial opportunity.

Yet, while labour market mobility poses a major managerial problem for the new venture, without that mobility the new venture would not have been able to gain access to this specialized labour in the first place. The types of people that a knowledge intensive startup wishes to recruit typically have alternative opportunities in established organizations. Relative to the secure employment that these established organizations typically offer, employment at a new venture is inherently insecure.

How then do new ventures attract the quantity and quality of 'talent' that they need to implement their innovative strategies? From the 1960s Silicon Valley high-tech firms began using 'broad based' employee stock options as the mode of compensation to attract personnel (Lazonick 2003a; Glimstedt et al. 2006). Previously stock options had been a perquisite reserved almost exclusively for top executives of US corporations. They functioned as a tax dodge; with the income from exercising options taxed at the 25 per cent capital gains rate, they avoided the 91 per cent marginal rates of taxation on the highest brackets of personal income in effect in the 1950s. Especially from the 1980s most Silicon Valley high-tech startups have offered stock options to virtually all of their employees – hence the term 'broad based'. A new venture often grants stock options to employees in lieu of a portion of the salary that they could have commanded working for an established organization, and thus conserves cash. Moreover, those individuals who are deemed to be 'stars' can be offered an extra large number of options as a signing bonus without upsetting the firm's normal salary scale or requiring the firm to expend cash upfront.

Nevertheless, the point of employee stock options, just as the point of human resource management more generally, is not simply to attract specialized labour or save on salaried compensation. Given the collective and cumulative character of the learning process, once an employee is hired the entrepreneur or her managers has to retain them, and having retained them, continuously motivate them. In a new venture, employee stock options help to perform both the retention and motivation functions.

So that stock options will perform the retention function, it is the practice in US high-tech for a block of options granted in any given year to vest in equal proportions at the end of each of the four following years. Once the options have vested, the employee has the right to exercise these options over a period of ten years from the original grant date. Thus the employee must stay with the firm for a period of time to have the prospect of cashing in on her stock options. Furthermore the practice in US high-tech firms is to

grant stock options on an *annual* basis, so that the employee always has more options waiting to vest and eligible to be exercised in the pipeline.

Besides attracting and retaining specialized employees, the entrepreneur has to motivate them to engage in an intense process of organizational learning. Established business enterprises can use the realistic promise of promotion within the organization over the course of a career to perform the motivation function. New ventures cannot realistically proffer such an expectation. In a new venture, broad based stock options can perform this motivation function giving the employees who hold them a strong incentive to contribute to the innovation process. The financial reward for their time and effort will come if and when the new venture has sufficiently developed and utilized its productive resources to do an initial public offering (IPO) or a private sale of the firm to a company that is already listed on the stock market. At that point the new venture's shares, which, not being traded, had previously been difficult to sell after employees exercised their options, now, having become tradable, can become very valuable.[8]

In a new venture, therefore, stock options can serve as a powerful tool for organizational integration. Stock options also serve, however, to dilute the entrepreneur's ownership stake as they are exercised, and as such manifest the collective character of the innovation process. At the same time, the use of this compensation tool creates an almost irresistible pressure for the firm to do an IPO,[9] thus tying its performance in the minds of the firm's participants to its prospective stock market valuation. One danger is that in a boom the financial opportunity will overwhelm the productive opportunity, as new ventures that have yet to develop a commercializable product go public and are, as a result, exposed to the demands of financial markets for regular returns.

Another related danger of a premature IPO is that those participants in the firm who hold large ownership stakes can, quite legally, gain incredible wealth from the new venture even though the firm whose stock yields them this wealth have not yet succeeded as a viable business enterprise (see Gimein et al. 2002; Carpenter et al. 2003; Lazonick 2007b). Especially in a speculative environment, the prospect of such gains can in turn attract entrepreneurs into the industry who lack the specialized knowledge of the industry required for innovative strategy, and whose main concern is with cashing in on the new venture whether or not it is a commercial success. Insofar as certain entrepreneurs are able to repeat this process, their 'serial entrepreneurship' may not contribute to innovation in the industry – or industries – in which they are involved.

This financial orientation of the new venture may be reinforced by the way in which it is financed. Although some entrepreneurs such as Paul Allen, co-founder of Microsoft and

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8 Besides the time and effort supplied by motivated employees, the value of stock options may be affected to a considerable extent by speculative swings of the stock market that alter the ease with which a new venture can do an IPO or a private sale to an established company. In the United States, over the years from 1990 to 2005 the average length of time from founding to IPO for venture-backed companies ranged from four years for 487 IPOs in 1999 at the peak of the Internet boom to 15 years for 70 IPOs at the depth of the subsequent slump. In 1999 there were 166 private sales of venture-backed companies for average proceeds (in 2005 dollars) of US$265.5 million, while in 2002 there were 157 such sales but average proceeds (in 2005 dollars) of only US$57.6 million (Ritter 2006).

9 For example, when in 1986 Microsoft, in which Bill Gates held a controlling stake, went public the sole purpose was to enable its 1,000 employees, who had begun to receive broad-based stock options in 1982, to sell on the open market the shares that they acquired from the options that they exercised.

now chairman of Charter Communications, may possess sufficient financial resources to launch and sustain a new venture without external funding, such is not generally the case. In the 1960s, in the context of the proliferation of semiconductor startups in what became known as Silicon Valley, venture capital became a major force in the financing of new ventures, and in the 1970s this form of finance emerged as an industry in its own right.

Of central importance to the success of US venture capital in supporting innovative enterprise has been the fact that many of the leading venture capitalists had themselves followed managerial careers in high-tech industry before becoming purveyors of finance to new high-tech firms. In playing this role, the most successful venture capitalists do more than provide what I have called financial commitment. They also participate in the exercise of strategic control, sitting on the boards of the new ventures that they have helped finance, and they are typically the ones who recruit managers to perform the firm's organizational functions instead of the entrepreneur. At the same time, as providers of venture finance, their prime objective is not to build the capabilities of, and reap the returns from, one company for their rest of their careers. Rather their aim is to 'exit' the firm at a propitious time in the not-too-distant future, either by going public with the new ventures in which they have invested or by doing a private sale to an established company. In this context, a well-developed stock market is an institution that permits founder-entrepreneurs and venture capitalists to exit from their investments, quite apart from whether an IPO also raises funds for the firm that has issued its stock. Under these institutional conditions, entrepreneurship may be ephemeral as an input into the innovation process; the entrepreneur disappears as the innovative enterprise lives on.

5 Entrepreneurship and the developmental state

An analysis of the functions of entrepreneurship in the innovation process shows that the success or failure of the entrepreneur is highly dependent on the set of social relationships in which she is embedded. The need for organizational integration and financial commitment generally means that the entrepreneur must share strategic control with professional managers and financiers. Large numbers of participants in the firm's hierarchical and functional division of labour need to be motivated to work together for a sustained period of time toward the achievement of collective goals. In the US context, the collective character of the innovation process in new ventures is all the greater when one considers that the vast majority of venture capital funds come from employee pension funds, university endowments, philanthropic foundations, and business corporations. Many rich individuals invest directly in new ventures, but such 'angel investing', while of greater importance in the 2000s than previously, is not the norm.

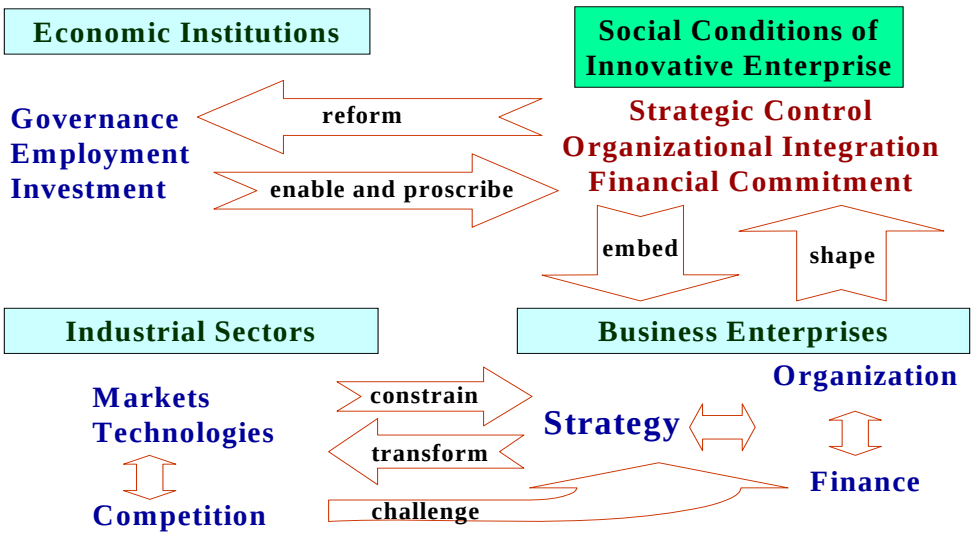
At the level of the business enterprise, the collective character of the innovation process reflects the reliance of the entrepreneur on the skills and efforts of other enterprise participants in the exercise of strategic control, the management of organizational integration, and the mobilization of financial commitment. Comparative-historical research on innovative enterprise across advanced nations and over time has revealed distinctive patterns in social structures that support the transformation of strategic control, organizational integration, and financial commitment into innovative outcomes (Lazonick 2007c). As illustrated schematically in Figure 3, I call these distinctive social

structures ‘social conditions of innovative enterprise’. Historically, as particular forms of these social conditions have provided the foundations for the growth of innovative enterprises in a national economy, and as enterprises characterized by these social conditions have grown to dominate resource allocation in the national economy as a whole, these social conditions of innovative enterprise themselves have become national norms for business behavior that have shaped the form and content of national governance, employment, and investment institutions.

For example, in the United States of the 2000s, reflecting the rise of what I have called the ‘New Economy business model’, governance institutions emphasize ‘maximizing shareholder value’, employment institutions emphasize interfirm labour mobility and stock options, and investment institutions emphasize venture finance and the use of corporate stock to combine with other companies (Lazonick 2006a). The characteristics of these institutions differ markedly from those that, reflecting the ‘Old Economy business model’ that prevailed in the post Second World War decades, emphasized corporate growth, career employment with one company, and long term debt finance. By contrast, Japanese economic institutions, although currently under some pressure for change, emphasize stable shareholding, permanent employment, and bank based finance, all of which evolved as social conditions of innovative enterprise in the major Japanese companies that grew to dominate the economy from the 1950s and transformed Japan into a rich nation by the 1980s (Lazonick 2005).

It is now widely recognized among scholars of comparative political economy that there exists a wide array of ‘varieties of capitalism’ that can provide the institutional bases for economic development (see Berger and Dore 1996; Crouch and Streeck 1997; Hall and Soskice 2001; Whitley 2002; Lazonick 2007c). Moreover, looking back over the past century, the changes in the governance, employment, and investment institutions that have characterized the leading capitalist economies have been profound. A century ago, Britain still had the highest level of GDP per capita in the world, and one could identify, as indeed Marshall (1920) did, the industrial districts around Manchester, Sheffield, and

Figure 3 Social conditions of innovative enterprise



Birmingham as the reasons why Britain could be known as the 'workshop of the world'. The thousands of relatively small companies that populated these districts produced commodities such as cotton textiles and metal housewares for export to markets around the world. Enterprise governance was based on either proprietorships or, as in the case of cotton spinning, highly localized, single-plant limited liability firms. In the leading export sectors, of which cotton textiles was by far the most important, new ventures used local stock markets to raise funds for rapid investments in new factories to respond to cyclical booms in demand. The foundation for British global supremacy in these industries was the availability of large local supplies of unionized labour with specialized craft skills (see Farnie 1979; Lazonick 1983; Farnie and Abe 2000).

In periods of strong product market demand, the ready availability of specialized craft labour induced new specialized manufacturing firms, often started by entrepreneurial craft workers, to set up in these districts. The growth of a district induced other firms to invest in regionally specific communication and distribution facilities for the supply of materials, the transfer of work in progress across vertically specialized firms, and the marketing of output. Regional concentration encouraged vertical specialization, which in turn eased firm entry into a particular specialty, thus resulting in high levels of horizontal competition. Firms could be owned and managed by the same people, or in the case of the limited liability spinning companies a single manager would direct the one-factory firms. There was no need to invest in the types of managerial organization that by the late nineteenth century were becoming central to the growth of firms, and the development of the economies, of the United States and Germany. In the industrial districts, economies of scale were, as Marshall argued, external, rather than internal, to the firm.

By the 1920s, the British industrial districts entered a decline from which they would never recover (Elbaum and Lazonick 1986). A half century later, however, the remarkable growth of the 'Third Italy', based on industrial districts of small scale enterprises clustered in Emilia-Romagna around Bologna, in Veneto outside of Venice, and in Tuscany in the vicinity of Florence, led some Italian economists, most notably Becattini (1992) and Brusco (1982), to look to the work of Marshall for an analytical framework for understanding the developmental dynamics that these districts possessed. Given the expansion of these industrial districts on the basis of relatively small scale enterprises, one could rightly point to the role of entrepreneurship as a significant force in the development of the Third Italy. At the same time, a more fundamental analysis of the development of these industrial districts revealed how individual entrepreneurship was embedded in and supported by a highly collective social structure. For example, in an influential essay entitled 'The Emilian Model: Productive Decentralization and Social Integration', originally published in Italian in 1980 and translated into English two years later, Brusco (1982: 167) presented 'a dynamic analysis of the interaction of the between the productive structure, the labour market, and the principal political institutions in Emilia-Romagna.'

There were a number of good reasons to refer to the Third Italy as 'Marshallian' industrial districts, as Becattini in particular was wont to do. The industrial activities of these districts focused on, among other things, textiles, footwear, and light machinery just as the British districts had done. Each industrial activity was populated by large numbers of vertically specialized proprietary firms in which craft labour was a prime source of competitive advantage and of which many entrepreneurs had previously been craft workers. Yet there were a number of major differences between the nineteenth

century industrial districts that Marshall observed and those that could be found in the Third Italy a generation after the end of the Second World War. The identification of these differences is of central importance for the analysis of how entrepreneurial activity flourishes, and reaches its limits, in difference social contexts.

The first major difference was the sheer diversity of specialized production by small firms in the Third Italy. Large numbers of the relatively small Italian firms were truly entrepreneurial as, within their specialized industrial activity, firms competed by differentiating their products for higher income and more sophisticated markets. While one could certainly find such entrepreneurial firms in the British industrial districts of the late nineteenth century, those districts and their constituent firms contributed to the growth of the British economy primarily through a system of mass production of standardized goods, even if it was one based on a proliferation of relatively small firms and craft labour.

The second characteristic of the Italian industrial districts that distinguished them from the British was the extent to which in Italy collective institutions supported the innovative activities of small firms. In the Italian districts, regional universities were important suppliers of both new knowledge and educated labour, quite in contrast to the craft based provision of these inputs in the British districts. Brusco emphasized the importance of the 'red' local governments in Emilia-Romagna in promoting policies to support the activities of small enterprises, and in particular in facilitating cooperatives that provided these firms with 'real services' related to financing, business administration, marketing, and training that they could not provide for themselves and which profit seeking specialized firms did not find it worthwhile to supply (Brusco and Pezzini 1990; Brusco 1992). While consumer cooperatives sprung up in the British industrial districts of the late nineteenth century – with the Lancashire town of Rochdale acquiring fame as the pioneer of the consumer cooperative movement – producer cooperatives were rare.

The third distinguishing characteristic of the Italian industrial districts that became more evident in the 1990s was the extent to which, in some districts and in some industries, 'leading' firms could emerge, drawing on the resources of the industrial districts while, through their own internal growth, transforming the innovative capability of the districts. A problem with the British industrial districts when they were confronted by competitive challenges in the first half of the twentieth century was that dominant firms failed to emerge to lead the restructuring of the districts. Indeed, over the past decade a major concern among many observers of Italian industrial districts has been whether the competitive advantage of regions based on a multitude of small entrepreneurial firms can be maintained when they are confronted by the rise of dominant global enterprises.

In Italy, a well-known early case of the emergence of a dominant firm is Benetton, a family firm in the Veneto area, known along with Emilia-Romagna and Tuscany for its industrial districts. Benetton grew from the last half of the 1960s by maintaining control over marketing, design, and logistics (including the rapid replenishment of fast selling shop inventories) while outsourcing production to small producers in its home region (and then increasingly abroad) and establishing a global brand name by franchising retail shops around the world (and subsequently investing in its own 'megashops') (see Harrison 1994). A similar dynamic of enterprise growth can be found in the rise of Natuzzi, since the early 1990s a leading global brand in upholstered furniture. Based in a newer industrial district in the south of Italy, Natuzzi has combined a tightly

integrated vertical supply chain with its own global marketing capabilities to outcompete the more specialized but once dominant furniture manufacturers in Emilia Romagna (Belussi 1999). In 2006 Natuzzi had sales of €736 million, and at the end of the year employed 8,133 people (3,590 in Italy and 4,543 abroad). As demonstrated in the cases of Benetton and Natuzzi, even in industries that are not high-tech, the overwhelming tendency is for entrepreneurial firms to grow large and dominate their industries; one can offer as a particularly well-known example Wal-Mart, the US retailing giant, launched as an entrepreneurial firm in the small town of Bentonville, Arkansas in 1950, that as of January 2007 employed 1.8 million people worldwide, generating US$349 billion in revenues and over US$11 billion in profits.

Yet if one wants to understand the vulnerability of the 'Marshallian industrial district' in long run historical perspective, one should go back to the 1920s and 1930s when the Japanese cotton textile industry outcompeted the once powerful British cotton textile industry in global competition. While the Japanese had the advantage of much lower wages and much longer working hours than the British, Japan's main source of long run competitive advantage in global competition was the higher productivity that its industry generated. The Japanese industry's high productivity was in turn based on the investment strategies and organizational structures of ten dominant 'spinning' companies (which from the beginning of the twentieth century also integrated weaving), all of which had been entrepreneurial startups in the 1870 and 1880s. These spinning companies relied on the global trading companies of the Japanese *zaibatsu*, most notably Mitsui and Mitsubishi, to supply them with cotton and sell their yarn and cloth, as well as, increasingly, on indigenous Japanese textile machine manufacturers to supply them with the latest equipment (Mass and Lazonick 1990).

In the 1920s, one entrepreneurial Japanese textile machinery company in particular took advantage of the opportunity presented by the rapid growth of the nation's cotton textile industry, and by the 1930s its weaving innovations had enabled Japan to become the world leader not only in the export of cotton cloth but also in the export of machinery for the weaving of cotton cloth. That firm was the Toyoda Automatic Loom Company. During the 1930s Toyoda strategically transferred its considerable capabilities in mechanical engineering and manufacturing to the development of automobiles under the name of Toyota Motor Company (changing the 'd' to a 't' in the family name so that its cars would not mistake its motor vehicles for its now famous weaving machines) (Mass and Robertson 1996; Wada 2006). In 2007 Toyota is poised to become the largest car manufacturer in the world.

Of much greater importance for present purposes, however, is the fact that the growth of Toyota was both central to and emblematic of the transformation of Japan from a poor nation in the 1940s to a rich nation in the 1980s. When in the 1980s and 1990s many 'non-neoclassical' scholars followed Johnson (1982) in focusing on the role of the 'developmental state' in the Japanese 'economic miracle', they generally failed to analyse the role of 'innovative enterprise' in this transformation (see Woo-Cumings 1999). As a direct result, they ignored two fundamental phenomena in the link between entrepreneurship and economic development.

First, they have missed the importance of enterprise strategy, organization, and finance in the transformation of entrepreneurial firms into innovative firms. The contribution of the developmental state in Japan to the wealth of the nation cannot be understood in abstraction from the growth of companies such as Toshiba, Hitachi, Toyota, Matsushita,

Sony, and Canon. While the Japanese state provided various forms of support for these companies, especially in the realm of bank based finance, it was a combination of strategy, organization, and finance internal to these companies that made them successful, and gave the state's industrial policy a chance of reinforcing that success. One needs a theory of innovative enterprise to understand not only the role of entrepreneurship in economic development but also the role of the state.

One can make the same argument for the importance of the growth of dominant firms in the process of economic development for the world's richest economy, the United States. Except, and here is the second phenomenon that Western scholars of the developmental state have entirely missed, in terms of technological innovation over the past century and to the present, *the US state has been far more developmental than the Japanese state.* Scholarly works have been written on particular industries – for example, agriculture (Ferleger and Lazonick 1993), airliners (Van der Linden 2002), aircraft engines (Constant 1980), computers (National Research Council 1999), the Internet (Abbate 2000), biotechnology (Lazonick et al. 2007) – that support this proposition.

As for Silicon Valley, the world's leading high-tech industrial district, the developmental state has been of central importance throughout its history. In agreement with this statement, judging from a 1984 article entitled 'Venture Capital & the Growth of Silicon Valley', is William R. Hambrecht, founder and principal of Hambrecht & Quist, a pre-eminent Silicon Valley investment banking and venture capital firm. 'There were three major catalytic events that occurred [from 1935 to 1950] that propelled our country into a position of technological leadership', Hambrecht (1984: 74) wrote. First, in the mid-1930s, the United States received a wave of European refugees, including some of the world's most prominent scientists and engineers. Second, during the Second World War the US government made massive investments in research and development. And third, in the aftermath of the Second World War, under the 'GI Bill', the US government paid for the university tuitions and subsistence costs of millions of people who might not otherwise have been able to afford a higher education. As Hambrecht (1984: 75) summed up the impact: 'A group of European scientists and engineers and the newly trained American engineers, fresh from their experiences in the R&D labs, went back to the universities and trained a whole new generation of engineers who in the 1950s and 1960s created the microelectronics revolution.'

Hambrecht's historical perspective on the origins of Silicon Valley, 'potted' though it is, finds ample support in the work of scholars such as Tilton (1971), Braun and MacDonald (1982), Flamm (1987, 1988), Leslie (1993a, 1993b), Norberg and O'Neill (1996), and Lécuyer (2006). In the late 1990s, under the auspices of the US National Research Council (NRC), a group of scholars published *Funding a Revolution: Government Support for Computing Research* (National Research Council 1999). 'Innovation in computing', the NRC (1999: 2) observed,

> stems from a complementary relationship among government, industry, and universities. In this complex arrangement, government agencies and private companies fund research that is incorporated into myriad new products, processes, and services. While the contributions of industry to the computing revolution are manifest in the range of new products, processes, and services offered, those of the federal government are harder to discern. Nevertheless, federal funding of major computing

> initiatives has often contributed substantially to the development and deployment of commercial technologies. Commercial developments, similarly, have contributed to government endeavors.

In the biotechnology industry, which has been booming in the 2000s, the flow of resources has been much more one way from the government to firms (see Lazonick et al. 2007; also Goozner 2004). Through the National Institutes of Health (NIH), the US government has long been the nation's (and the world's) most important investor in knowledge creation in the medical fields. Since its inception in 1938 through 2006, US taxpayers invested US$569.6 billion in 2006 dollars in the work of the NIH. In 2006 US Congress appropriated US$28.5 billion to fund the work of the NIH. In its 27 centers and institutes in Bethesda, Maryland, the NIH supports the medical research of 6,000 scientists and technicians. But in house research absorbs less than ten per cent of the NIH budget, and administration another nine per cent. In 2007 NIH planned to award US$23.7 billion of its US$29.2 billion for research, training, fellowships, and R&D contracts in the form of '50,000 competitive grants to more than 325,000 researchers at over 3,000 universities, medical schools, and other research institutions in every state and around the world'.[10]

The business sector has direct access to, and can appropriate high returns from, this state funded research. In 1978 intense lobbying by the National Venture Capital Association and the American Electronics Association, both with their centers of gravity as cohesive trade associations in Silicon Valley, convinced the US Congress to lower the capital gains tax rate from 49 per cent to 28 per cent, thus reversing a 36-year trend toward higher capital gains taxes. The Bayh-Dole Act of 1980 gave universities and hospitals clear property rights to new knowledge that resulted from US government funded research so that they could license the results of their research to new technology firms. The main motivation for Bayh-Dole was the growing number of biotech inventions emanating from NIH research that, it was argued, would be left unexploited but for the Act's less restrictive conditions for the transfer of intellectual property. In 1980 as well, a Supreme Court decision that genetically engineered life forms are patentable facilitated the opportunity for the types of knowledge transfers that Bayh-Dole envisioned. The magnitude of the gains that could be reaped from biotech startups became apparent when Genentech, founded in 1976, raised US$36 million in its IPO in 1980, to be followed by, at the time, the largest IPO in US history, the US$107 million raised by Cetus, another San Francisco Bay area company that dated from 1971.

In 1983 another important inducement to biotech investment followed in the form of the Orphan Drug Act, which gave generous tax credits for research and experimentation as well as the possibility of seven-year market exclusivity for companies that developed drugs for 'rare' diseases. It was argued that without these financial incentives many potential medicinal drugs that could be developed for relatively small markets would remain 'orphans': pharmaceutical or biotech companies would not have been willing the make financial commitments of the size and duration required to nurture these drugs from infancy to adulthood. By December 2006 the FDA had designated 1,674 orphan drug submissions that made these companies eligible for the tax credits and had granted market exclusivity on 301 drugs that had reached the approval stage. A number of these

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[10] http://www.nih.gov/about/budget.htm; http://grants1.nih.gov/grants/award/trends/DistBudget07.jpg.

orphan drugs are now ‘blockbusters’ with US$1 billion or more in annual sales. The US government, through its Medicare and Medicaid programs, moreover, remains the leading source of effective demand for these high-priced biotech products.

In sum, the United States has had, and still possesses, a formidable developmental state. As for Japan, it was able to grow rich without its state being as developmental as that of the United States precisely because its firms could take advantage, through licensing and joint ventures, of knowledge created in the United States and other advanced western nations. Nevertheless, the further development and utilization of this knowledge to engage in indigenous innovation required that the Japanese firms have sufficient ‘absorptive capacity’.[11] The cases of the Toyoda automatic loom and the Toyota automobile, already mentioned, are examples of such indigenous innovation.

To have this absorptive capacity and engage in indigenous innovation, a nation has to have already made the most strategic and most expensive investment of them all: investment in a public system of primary, secondary, and tertiary education. The economic institutions that support entrepreneurship and innovation in the United States and Japan may differ radically, but what these as well as other advanced economies have in common are long histories of massive investments in their educational systems.

US government investment began with the Morrill Land Grant Act of 1862, out of which emerged a nationwide system of higher education oriented toward industrial development, including universities such as MIT, Cornell, Michigan, Purdue, Iowa, and University of California Berkeley (Ferleger and Lazonick 1994). In the development of Silicon Valley, the key player was Stanford University, a private university founded in 1885 on the basis of railroad wealth. From the 1930s Stanford oriented itself to support industrial development. The key ‘public entrepreneur’ was Frederick Terman. With an electrical engineering doctorate from MIT, Terman was a professor of engineering at Stanford in the 1930s, spent the Second World War directing the Harvard University Radio Research Lab, returned to Stanford after the war as its dean of engineering, and became the University’s provost in the 1950s. Two of Terman’s students in the 1930s were William Hewlett and David Packard, who in 1939, on the urging of Terman, founded the eponymous firm adjacent to Stanford.

The founding of Hewlett-Packard reflected Terman’s vision of Stanford as a high-tech industrial district that would spawn startups (Leslie and Kargon 1996). In the Boston area, Georges Doriot, a professor at Harvard Business School had a similar vision. After the Second World War, Doriot and a number of academic and business leaders in the Boston area, through the pioneering venture capital firm, American Research & Development, made a conscious and successful attempt to commercialize the military technologies that had accumulated at the Massachusetts Institute of Technology, by far the most important university in the nation for military research (Hsu and Kenney 2005). The result by the 1950s was the emergence of ‘Route 128’ in the Greater Boston area as the world’s leading high-tech industrial district.

Highly aware of these efforts on the East Coast, in his 1946–47 Dean’s Report of the Stanford School of Engineering, Terman issued a call for the western United States to

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11 On the concept of ‘absorptive capacity’, see Cohen and Levinthal 1990.

make use of its institutions of higher education to foster indigenous innovation (quoted in Leslie 1993a: 55).

> The west has long dreamed of an indigenous industry of sufficient magnitude to balance its agricultural resources. The war advanced these hopes and brought to the west the beginning of a great new era of industrialization. A strong and independent industry must, however, develop its own intellectual resources of science and technology, for industrial activity that depends upon imported brains and second hand ideas cannot hope to be more than a vassal that pays tribute to its overlords, and is permanently condemned to an inferior competitive position.

In the post Second World War decades, economies such as Japan, South Korea, and Taiwan would adopt precisely this perspective on industrial development, with the education of the population as the foundation.[12] In the case of Japan, laws dating back to 1886 made primary education universally free and compulsory, and by 1909 98 per cent of all school age children went to primary school (Koike and Inoki 1990). Japan also developed a system of higher education from the late nineteenth century that sent its graduates into industry (Yonekawa 1984). Additionally, also from the late nineteenth century, Japanese companies engaged in the practice of sending university educated employees abroad for extended periods of time to learn about Western technology (see, for example, Fukasaku 1992). Of utmost importance to Japan's post Second World War development was the fact that for decades Japanese industrial enterprises had made university educated engineers integral to their managerial organizations (Morikawa 2001: 62–63).

These investments in education meant that in 1960 only 2.4 per cent of Japan's population, aged 15 and over, had no schooling while on average this population had 7.78 years of schooling (the US figures were 2.0 per cent and 8.49 years). By contrast, in 1960 the no-schooling proportions were South Korea, 42.8 per cent; Taiwan, 37.3 per cent; Singapore, 46.2 per cent; and Hong Kong 29.7 per cent; while the average years of schooling of these populations were South Korea, 4.25; Taiwan, 3.87; Singapore, 4.30; and Hong Kong, 5.17 (Barro and Lee 2000). A major challenge that faced the would be 'Asian Tigers' was to transform their national educational systems into a foundation for industrial development. In South Korea, as the most dramatic example, average years of schooling of the 15-plus population rose from 7.91 years in 1980 to 10.84 in 2000, surpassing Japan's 2000 figure of 9.47 and not far behind the US figure of 12.05 (Barro and Lee 2000). By last half of 1990s South Korea had the highest number of PhDs per capita of any country in the world (Kim and Leslie 1998: 154).

India, a nation with 680 million people aged 15 or over in 2000 compared with South Korea's 37 million, has not invested in such a dramatic transformation of its mass education system. In 1960 the Indian 15-plus population included 72.2 per cent with no schooling, and had on average 1.68 years of schooling. In 2000 India's no-schooling figure remained high at 43.9 per cent, while the average years figure was only 5.06.

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12 Indeed, in the late 1960s and early 1970s Terman and his disciples were key advisors to the Koreans in the setting up of what became the Korea Advanced Institute of Science and Technology (KAIST) (see Kim and Leslie 1998).

India, with one sixth of the world's population, has one third of the world's illiterates. Nevertheless in the post Second World War decades, given the size of its population and the legacy of British colonial rule, India did have large numbers of university graduates – so many if fact that as late as the first half of the 1990s India's problem was less brain drain and more the nation's millions of educated unemployed. In British fashion, Indian university students favoured the study of science over engineering. In the 1950s and 1960s, however, the Indian government, with the assistance of US universities and foundations, invested in the system of Indian Institutes of Technology that are currently of critical importance to high-tech development in that nation. Over the past decade educated Indians have also been far and away the most numerous of all nationalities in following global career paths to the United States, on temporary work visas and as permanent residents, for graduate education and work experience (see Lazonick 2006b).

For those nations that made these investments in education, since the 1960s the development strategies of East Asian nations have interacted with the investment strategies of US based high-tech companies to generate a global labour supply.[13] This process has entailed flows of US capital to East Asian labour as well as flows of East Asian labour to US capital. As a result new possibilities to pursue high-tech careers, and thereby develop productive capabilities, have opened up to vast numbers of individuals in East Asian nations. Many found the relevant educational programs and work experience in their home countries. But many gained access to education and experience by following global career paths that included study and work abroad, especially in the United States.

For East Asian nations, these global career paths have posed a danger of 'brain drain': the career path could come to an end in the United States (or another advanced economy) rather than in the country where the individual had been born and bred. Education and experience in the United States created, however, valuable 'human capital' that could potentially be lured back home. A major challenge for the East Asian nations has been the creation of domestic employment opportunities, through a combination of foreign direct investment (FDI), strategic government initiatives, and the growth of indigenous businesses, to enable the career paths of global nationals to be followed back home, thus transforming a potential 'brain drain' into an actual 'brain gain'.

Historically, FDI by multinational corporations (MNCs) has been an important source of high-tech employment creation in these nations, mainly because even when they have gone to these countries in search of low wage labour, the MNCs have also employed indigenous scientists, engineers, and managers. US MNCs such as Motorola in South Korea from 1967, Intel in Malaysia from 1972, and Texas Instruments (TI) in India from 1985 created some of the first attractive opportunities for nationals to pursue high-tech careers at home.

The greatest impact on innovation and development comes, however, from the creation and growth of indigenous firms. When high-tech employment is dependent on MNCs,

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13 The following draws on Lazonick (2006b). A longer, unpublished version of this paper is Chapter 7 of my forthcoming book on the conditions of high-tech employment in the United States that can be found at http://www.uml.edu/centers/CIC.

there are limits to the transfer of high quality employment to the host nation, whereas indigenous companies maintain strategic control over the location of job creation. Many of the founders of these indigenous companies have been part of the 'reverse brain drain' from the advanced economies (Saxenian 2006). Some founders and many key employees have followed career paths entirely at home, going from MNCs to indigenous companies.

In the case of South Korea, indigenous investments by government and business rather than FDI have since the late 1980s driven the development of domestic high-tech capabilities. In the 2000s these indigenous investments are creating new opportunities for high end investment by MNCs in South Korea, including new investments by a company such as Motorola that has been doing business there for almost 40 years. In contrast, in the absence of leading indigenous high-tech companies, Malaysia's growth still remains highly dependent on the upgrading strategies of MNCs such as Intel. Like Motorola in South Korea, Intel originally went to Malaysia in search of low wage assembly labour in a politically stable country that had made a commitment to mass education. And like Motorola Korea, Intel Malaysia upgraded its capabilities over time, employing a higher proportion of high skill labour in higher value added activities at rising wages.

Like Motorola in South Korea and Intel in Malaysia, TI originally went to India in the mid-1980s in search of low wage labour. TI, however, was not searching for low skill labour. What first attracted TI to India was the availability of highly educated engineers and programmers, albeit at much lower wages than would have had to be paid in the United States. Over time TI expanded and upgraded its Indian operations, employing larger numbers of educated labour to design increasingly complex products. Two decades after TI came to India, the nation is experiencing a growth dynamic in which, with both skill levels and wages rising, indigenous companies such as Tata Consultancy Services, Infosys, and Wipro are taking the lead, and in which MNCs are being attracted to India more for the high quality of its high-tech labour supply than for its low cost.

A similar process of indigenous innovation has been taking place in China, but with the difference that indigenous Chinese companies such as Lenovo and Founder have emerged to serve the growing Chinese consumer and business markets, and have drawn upon the capital goods expertise of MNCs such as Intel, TI, Motorola, and HP to develop higher quality, lower cost products. Some of these companies – Lenovo and Founder are prime examples – have become leading competitors not only in China but also internationally (Lu 2000; Lu and Lazonick 2001; Xie and White 2004). While there are large numbers of Chinese high-tech employees who have acquired higher education and work experience in the United States, the vast majority have been receiving education and experience in China.

Given the growth dynamic that has taken hold in these nations, sheer size ensures that Indians and Chinese will dominate the expansion of the global high-tech labour supply. Combined, the population of India and China is 33 times that of South Korea and Taiwan. India and China have rapidly growing domestic markets that both provide demand for the products of indigenous companies and give their governments leverage with MNCs in gaining access to advanced technology as a condition for FDI. While India and China offer indigenous scientists and engineers rapidly expanding employment opportunities at home, vast numbers of their educated populations are studying and working abroad. Aided by the ongoing liberalization of US immigration

policy (impeded just temporarily by the reaction to 9/11), the global career path is much more of a 'mass' phenomenon for Indian and Chinese scientists and engineers than it has been for the Koreans and Taiwanese. History tell us that, following global career paths, more and more Indian and Chinese high-tech labour will migrate back to their countries of origin, where as Saxenian (2006) has shown, they have been an important source of high-tech entrepreneurship.

The cases of South Korea and Taiwan should give pause to arguments that investments in knowledge intensive sectors are not of much relevance to the very poor nations such as those in Africa. While most African nations are certainly not well-positioned to compete in high-tech industry, it must be remembered that South Korea's GDP per capita was only 10 per cent of that of the United States in 1960 and 13 per cent in 1970, while that of Taiwan was just 13 per cent in 1960 and 20 per cent in 1970 (Maddison 2007). In 2003 South Korea's GDP per capita was 54 per cent of that of the United States and Taiwan's 60 per cent. In the 1980s and 1990s through 'indigenous innovation' – improvements on technologies that are transferred from abroad – these nations, like Japan about a quarter century before, transformed themselves from poor nations into rich nations. Now China and India, with one third of the world's population, are also developing rapidly on the basis of indigenous innovation.

It would be very misleading to attribute the development of China and India to a sudden emergence of entrepreneurship. There is no doubt that entrepreneurship has been unleashed in these nations. It is a phenomenon, however, that is only explicable through an analysis of the changing social conditions of innovative enterprise.

6 Concluding remarks

How does a nation get on this development path? National investment in educating the labour force is the foundation of economic development. This investment must be done ahead of demand, thus creating the problems of brain drain and the educated unemployed. The solution to these problems is domestic employment provided by government agencies, MNCs, and indigenous businesses that can make use of an educated labour force, absorbing those who have not gone abroad and eventually attracting back a portion of those who have.

In need of study are the conditions under which these employment opportunities are created. Entrepreneurship, or the formation of new indigenous firms, is one way in which this employment can be created. But, in higher value added industries, entrepreneurship assumes a supply of entrepreneurs who have already secured not only the relevant education but also the substantial work experience needed to give them an intimate knowledge of the technological, market, and competitive conditions of the particular industries in which they will launch new ventures.

Given national investments in a primary, secondary, and tertiary educational system that will provide a foundation for a portion of the indigenous population to secure advanced education and high-tech work experience, there are three possible sources of a supply of indigenous entrepreneurs: (a) government employment in research institutes and educational institutions, (b) employment at MNCs operating within the nation, and (c) employment abroad that culminates in 'reverse brain drain'. The histories of South

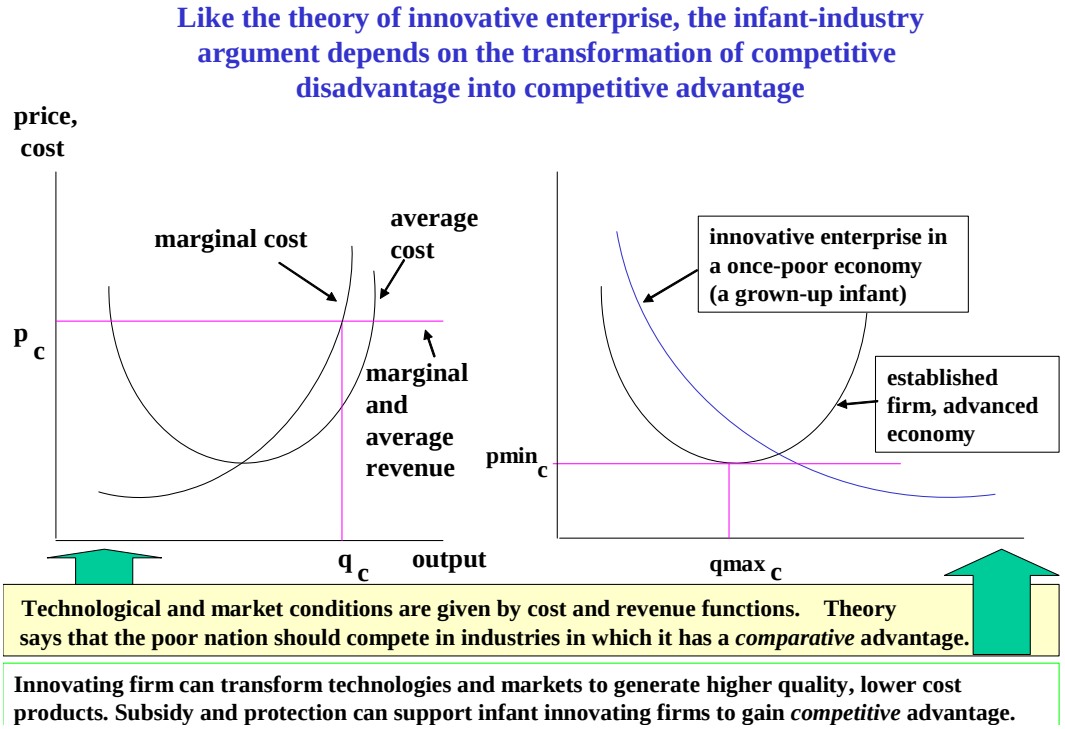
Korea and Taiwan show that these three sources of entrepreneurship all played roles in the process of creating the entrepreneurs who were involved in creating the indigenous enterprises that led the remarkable transformation of their economies from the late 1960s to the early 1990s. The same dynamic is now working itself out in India and China. Further research is needed to document in detail this process of creating a supply of effective entrepreneurs in developing economies.

I have also argued, however, that it is erroneous and, from a policy perspective, dangerous to view the creation of a supply of entrepreneurs as not only the beginning but also the end of the process of venture creation. Entrepreneurs by definition launch a new venture, but the types of people who are able and willing to engage in this activity may be ill suited to manage a complex organization that must engage in collective and cumulative learning. The innovation process requires the integration into the organization of professional, technical, and administrative personnel who are willing to stay and build companies that they did not found and which they do not own. Policies that place too much stress on entrepreneurship as the key to economic development can undermine the collective and cumulative process of organizational learning required for innovation to occur. Further research is needed to identify the types of employment institutions that support, or undermine, organizational integration in developing economies.

In addition, I have argued that the transformation of a new venture into a going concern requires committed finance. Financial markets provide liquidity – the opposite of commitment. The challenge for the entrepreneur is to mobilize financial resources from those who, despite the inherent uncertainty of a new venture, will eschew the liquidity that the market provides to invest in a startup. In doing so, these financiers become dependent on the new venture to overcome the technological, market, and competitive uncertainties that it faces so that at some point, perhaps sooner but often (if ever) later, it can generate a financial return. In the advanced economies, different institutional arrangements have evolved to provide this financial commitment to new ventures, ranging from Japanese-style bank based finance to US-style venture capital finance. The problem with the Japanese arrangement is that it does not discriminate among commercial borrowers on the basis of risk, and hence when the economy has been growing slowly has tended to show up on the banks' balance sheets as excessive bad debt (Lazonick 2005). The problem with the US arrangement is that, in relying on volatile stock markets to generate returns to venture capital, it has contributed to instability and inequality in the economy (Lazonick 2007b). Further research could seek to determine the forms of financial commitment that are best suited to stable and equitable economic growth in developing economies.

A critical dimension of the development process is the sharing of the gains from innovative enterprise. Policies to promote development must take into account the need for the government to share in the gains so that it can reinvest in the education of the labour force as well as in physical infrastructures. The labour force also needs to share in the gains of innovative enterprise so that it can enjoy a higher standard of living and augment the level of domestic consumer demand. In a developing economy such as China, the challenge at this point is not economic growth but rather the great increase in income inequality that accompanies it. We need to understand better how incentives can be created to promote entrepreneurial ventures in developing economics while ensuring an equitable distribution of the gains from innovation.

Figure 4 The theory of innovative enterprise and the infant industry argument



The areas for further research identified here entails challenges to economic orthodoxy concerning both the efficacy of market forces and the inefficacy of state intervention. In my discussion of the developmental state, I have argued that, contrary to prevailing ideology, even in the advanced economies, governments contribute to development by protecting and subsidizing indigenous industry. The standard argument against government subsidy and protection of industry is based on the theory of the market economy with its optimizing firms that simply respond to market forces. It is a theory that is fundamentally flawed when it seeks to show the superiority of perfect competition over an industrial structure in which some firms have gained a dominant share. The theory of the market economy fails to ask how, within an industry, some firms can through innovation gain a competitive advantage over other firms, and drive the development of the economy.

In contrast, the theory of innovative enterprise that I have laid out explains why government can support the process of development by subsidizing and protecting infant firms in infant industries. In particular, it provides a critical response to the neoclassical contention that state intervention and subsidies to industry can only undermine the economic progress of a nation. Chang (2002) has shown that neoclassical ideology has been instrumental in 'kicking away the ladder' of industrial policy that the developed nations have themselves climbed to become rich, thus seeking to deny developing nations from scaling the same heights. The theory of innovative enterprise that I have presented in this paper provides the microfoundations for understanding the conditions under which such industrial policy might succeed.

In effect, the dynamics of the innovating firm that are depicted in Figure 4 (which is a direct adaptation of Figure 1) explain why in the face of established international competition, tariff protection, or some other type of subsidy, may be necessary to

transform the high fixed costs of a innovative strategy into low unit costs. It also explains why the success or failure of state support for industry will depend on the social conditions of innovative enterprise. Within this framework, state subsidy provides the firms that constitute a national industry with a source of financial commitment while they are engaging in indigenous innovation, and have yet to transform the high fixed costs of that innovation strategy into low unit costs. But financial commitment in and of itself does not, and cannot, ensure the success of an innovative investment strategy. Given the financial commitment provided by tariff protection or other types of subsidies, it matters who exercises strategic control and what types of investments in organizational learning they make.

Arguments for the efficacy of state subsidy for developing economies need to specify the 'business model' that will combine strategic control, organizational integration and financial commitment to generate innovation as a foundation for economic development. The theory of innovative enterprise does not 'explain' economic development. That explanation must be sought in the social conditions of innovative enterprise that prevail in a particular time and place. The theory of innovative enterprise provides a coherent analytical framework for researching the characteristics of those conditions and for devising policies that, for the sake of economic development, can help to ensure that relevant conditions of innovative enterprise are in place. Innovative enterprise, I have argued, is the essential, and logical, link between entrepreneurial ventures and the development state.

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