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RESEARCH PAPER

The contribution of management to economic growth: a review

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A review of the literature indicates that the contribution of management to economic growth has been largely obscured in theory and ignored in empirical work. In contrast, the place of the entrepreneur in the process of growth is well recognised and widely accepted. The main goal of this paper is to develop an argument for the place of management in the process of growth, and to maintain that in the modern free market economy management's role is at least as important as that of the entrepreneur. Routine innovation in established firms is emphasised as a fundamental, normal part of management activity, and as such highlights the importance of management for economic growth. However, management is not homogeneous and the actions of managers differentially affect the performance outcomes of firms. Hence the quality of management, and the adoption of appropriate management practices, matters and directly impacts economic growth. In recognising that management makes a significant contribution, both in terms of ensuring efficiency in the use of factor inputs and effectiveness in terms of driving incremental innovation, new research is necessary at the firm level in order to develop this understanding.

Introduction

The central concern of this paper is the question: what is the contribution of management to economic growth? A review of the literature indicates that the contribution of management to economic growth has been largely obscured in theory and ignored in empirical work. In contrast, the place of the entrepreneur in the process of growth is well recognised and widely accepted. The main goal of this paper is to develop an argument for the place of management in the process of growth and to maintain that, in the modern free market economy, management's role is at least as important as that of the entrepreneur. It is necessary to ask whether the functions of the entrepreneur and those of the manager are substitutes or complements, or indeed sometimes the same thing in that it is possible to conflate the two roles.

Economic growth is the ability of the economy to produce ever more goods and services of value to its members (Solow and Temin, 1989, p.76). The welfare implications of economic growth are therefore enormous, with even small changes in growth rates producing large, long-run effects. Cowen (2011, pp.15–16) makes the point as follows: at a growth rate of 2% a year, an economy doubles in size about every 35 years, and living standards double too. At a 3% rate of growth, living standards double about every 23 years, about once every generation. After 75 years, one society will be about twice as rich as the other. After 140 years, one society will be four times wealthier than the other.

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As background to the discussion of the role of management in economic growth, it is necessary to note the importance of institutions, in particular a sound legal framework whereby individuals are protected against arbitrary incursions on their property and other economic rights (Harberger, 1998, p.23). Institutions are seen as a vital element for a sustained process of successful economic growth (Barro and Sala-i-Martin, 1994; North, 1996; Olson, 1996). Where an economy lacks the institutions that entice a sufficient number of individuals to become entrepreneurial, it will not achieve high levels of productivity and growth (North and Thomas, 1973; Hall and Jones, 1997; Ardagna and Lusardi, 2010).

A requirement of successful economies is that they have institutions that encourage individuals to earn their income through engaging in value-added activities (productive wealth seeking) rather than rent seeking (redistributive wealth seeking). However, high-quality institutions are a necessary but not sufficient condition for economic growth as there is still a need for a supply of able entrepreneurs and managers (i.e. individuals with a desire to prosper through private enterprise). What matters for growth is not just the existence of appropriate institutions, but also a responsive set of entrepreneurs and managers who desire to prosper in the context of the framework provided by the institutions.

The paper is structured as follows. In the next section, a brief review of economic growth theory is provided in order to identify the prime contributors to growth in standard models. It will be noted that such models make no explicit reference to management as a contributing factor to growth, but the section argues that management actually underpins the identified contributors. The third section elaborates on the role of management in economic growth. The fourth section argues that management is not homogeneous and that the actions of management differentially affect the performance outcomes of firms. In this sense, the quality of management and the adoption of appropriate management practices matter and directly affect economic growth. The final section presents some conclusions.

Models of economic growth

The neoclassical view

In neoclassical growth theory (for example, Solow, 1956), the production function assumes constant returns to scale and diminishing marginal products for all factors. Technical progress is neutral (leaving the relative marginal productivities of capital and labour unchanged) and disembodied (it does not depend on the inputs of capital and labour). In the long run, the economy grows at the natural rate set by exogenous labour force growth and technical progress. Thus, the steady-state growth rate is independent of the rates of savings and investment, and the capital–output ratio is constant. If technical progress is freely available to all countries, in the long run the model allows no cross-country divergence in growth rates of income per head, and different levels of *per capita* income result only from differences in capital–labour ratios.

Growth is thus decomposed, using an aggregate production function, into contributions from different sources, namely the growth rates of factor inputs weighted by competitive factor shares (the ‘contributions’ of factors) plus a residual.[1]

This residual is often labelled technical progress. A simple version of the neoclassical model takes the Cobb–Douglas form:

$$Y = A(t)K^{1-b}L^{b}.$$

In this expression, Y denotes net national product, K denotes the stock of capital, L denotes the stock of labour, and A denotes the level of technology. The terms $1–b$ and b are the shares of profits and wages in national income (taken to proxy the elasticities of output to capital and to labour). The notation indicating that A is a function of time signals the standard assumption in neoclassical or exogenous growth models: the technology improves for reasons that are outside the model.

Neoclassical models maintain that growth could be sustained by continuing accumulation of factor inputs. In the type of formulation provided above, there is a sense in which 'growth just happens'. Although it might be accepted that 'All theory depends on assumptions which are not quite true' (Solow, 1956, p.65), it would appear to be entirely unrealistic just to maintain that growth is a function of capital, labour and technology, without identifying some element or factor which combines these in the right proportions, sets the task, and sees to its accomplishment. Yet, in the standard models there is no explicit notion of any actor bringing labour and capital together to generate economic output or of organising to generate improvements in technology. There is no role for managers of firms in such models.

It is, of course, possible to include management as a separate factor in the aggregate production function. If management is assumed to be a separate factor, this raises an important distinction (Kindleberger, 1965, p.118). In the standard model, factor inputs tend to be substitutable one for another. So, capital can be substituted for labour, and *vice versa*, or labour for technology, and *vice versa*, etc. This means that in the general, continuous case, a given level of output can be produced by a wide variety of different input combinations (i.e. one input may be substituted for another in producing a specified volume of output). However, management appears to be a special case in that it is a complement input rather than a substitute input. In other words, management complements the other factor inputs, and the other factor inputs cannot be substituted for management. This implies that management is an irreducible necessary input to the growth process. Despite the absence of management in standard models, it seems reasonable to maintain that management is a separate factor, given the important role that management has in determining the optimal combination of factor inputs and the process of technological innovation, which will be argued further below.

Rather than including management as a separate factor, an alternative would be to include management outcomes in A. The model set out above characterises A as the level of technology, as is common in the literature, but changes in A in a growth accounting framework can also be interpreted as representing improvements in total factor productivity or real cost reduction (RCR). Harberger (1998, p.3) notes that RCR is probably on the mind of most managers at some point in any given week. Further, the residual viewed as RCR:

> … gives the residual body, in the sense that the number of dollars saved by real cost reduction is a tangible and measurable quantity. It gives the residual a name (real cost reduction), an address (the firm), and a face (the face of the entrepreneur, the CEO, the production manager, etc.). (Harberger, 1998, p.4)

This perspective provides a natural link between *A* in the aggregate production function and micro-level firm behaviour, with the latter appearing to be the appropriate level to explore this in more detail, especially as productivity varies significantly across firms, even in the same industry. Consequently, to understand aggregate growth, it is necessary to examine the sources of growth at all levels, including the firm level. It is clear that economic growth, particularly that arising from innovation, originates from the activities of individuals and business firms. A full understanding of growth, therefore, requires a micro perspective (Baumol, 2010, p.xii). This is stated emphatically by Harberger (1998, p.26), who concludes that 'the great bulk of the action associated with the growth process takes place at the level of the firm'. The basic point is that what happens at the micro level feeds upwards into aggregates (Syverson, 2011, p.327).

Endogenous growth theory

For many researchers, it became increasingly apparent that Solow-type models do not identify the mechanism by which real-world growth truly is sustained (Grossman and Helpman, 1994). As Stern (1991) points out, the approach of the standard neoclassical model was unsatisfactory from the point of view of explaining growth since, apart from misgivings about the use of aggregate production functions for this purpose, it still left a major part of the sources of growth to be explained exogenously by 'technical progress'. To many researchers it appeared that most technological progress requires, at least at some stage, an intentional investment of resources by profit-seeking firms. This view led researchers to argue that the 'energy' for growth (Beinhocker, 2007) should be considered endogenous to the economy and began the development of what became known as endogenous growth theory. This led to the development of formal models that cast industrial innovation as the engine of growth (see, for example, Romer, 1990; Grossman and Helpman, 1991; Aghion and Howitt, 1992; Barro and Sala-i-Martin, 1994). Thus, researchers began to examine growth that is endogenously determined by technical change resulting from decisions of profit-maximising agents (see Verspagen, 1992, and Ruttan, 1997, for surveys of such innovation and R&D based endogenous growth models). Importantly, Romer (1994, p.12) has made the point that technological advance comes from things that people do: 'No economist, so far as I know, has ever been willing to make a serious defense of the proposition that technological change is literally a function of elapsed calendar time'.

Endogenous growth models are not without criticism, however. For instance, Wong *et al*. (2005) conclude that while such models focus on innovation as a source of economic growth, these models do not provide any direct test of the effect of entrepreneurial firm-formation activities on economic growth. In acknowledging that endogenous growth models have made a major breakthrough by inaugurating a formal theory of endogenous innovation, Baumol (2004, p.9) argues that such models are not designed to deal with the difference between the growth record of capitalism and that of other economic forms. As these models do not contain elements that are particularly characteristic of a free market economy, because all explicit references to the special features of free market economies have been expunged, Baumol considers their analysis is ahistoric and macroeconomic. Importantly, for Baumol (2004, p.16) they have not sought to explore the heart of the free market growth process, which is the competitive pressure that forces firms to create, seek out and promote

innovation. Further, where they do take account of innovation, the mechanism of the activity enters only implicitly. There is no formal relationship that attempts to explicate, for example, the incentive structure that determines the magnitude of innovative activity.

The role of entrepreneurs and managers

It is apparent in the formal models discussed above that there is no explicit role for either entrepreneurs or managers in contributing to economic growth. It should be further noted that in standard economic analysis there is no role for the entrepreneur. The mainstream body of economic analysis neglects the entrepreneur because it has no need of such a figure in order to analyse its main object of concern: the decentralised allocation of resources (i.e. neoclassical theory is concerned with the behaviour of markets, not firms). The theoretical firm of mainstream economic analysis is therefore 'entrepreneurless' (Baumol, 1968).

Although there is no place for the entrepreneur in the standard economic model, in the economic literature more generally there has been a good deal of discussion of the nature and function of the entrepreneur. Economists in general have adopted a functional approach to the definition of the entrepreneur which specifies a certain function and deems anyone who performs this function to be an entrepreneur. Economists have stressed several functions; for instance, bearing of risk and uncertainty (Knight, 1921); innovation (Schumpeter, 1911); and perception and adjustment (Kirzner, 1973).

Interestingly, in an early contribution, Harbison (1956, p.364) points out that entrepreneurs have also been equated with the organisation and management of a business enterprise. He recalls that some of the classical economists had a broad concept of entrepreneurship. For instance, for Adam Smith (1776) the entrepreneur is a proprietary capitalist, a supplier of capital and at the same time a *manager* mediating between employees and consumers. Later Marshall (1890) assigned to the entrepreneur the functions of risk-bearing, innovation and management. Harbison (1956, p.365) argues that Marshall's concept, because of its comprehensiveness, is probably the most realistic in explaining the activities of modern complex business enterprises. However, the weakness of the argument is the implicit assumption that the entrepreneur is an individual person. It is likely that a single individual will be able to perform all of Marshall's entrepreneurial functions only in a very small firm. In reality, most enterprises require a hierarchy of individuals to perform the functions. Thus, the entrepreneur is embodied in an organisation which comprises all the people required to perform entrepreneurial functions. In this sense, the primacy of the entrepreneur appears to have been exaggerated at the expense of the fundamental nature of management.

Despite the absence of the entrepreneur in the prevailing standard model, and different views of the functions of the entrepreneur, there is a long held view that entrepreneurs are important in promoting economic growth, basically through the establishment of new firms and the introduction of innovations. However, the primacy of the entrepreneur underlying these sources of growth is contested, as is discussed below. In contrast, little has been acknowledged regarding the role of management in economic growth.

Entrepreneurs and economic growth

Schumpeter (1911) assigned the key role in economic growth to the disruptive activity of entrepreneurs, which feeds a 'creative destruction' process (Schumpeter, 1942) by causing constant disturbances to an economic system in equilibrium. The entrepreneur is the person who sees the opportunity for introducing a new technique or a new commodity, an improved organisation, or for the development of newly discovered resources. Schumpeter's emphasis on entrepreneurship as the vital force in the whole economy is the feature of his system that has found its way most frequently into later theories of growth.

Importantly, Schumpeter made the distinction between invention (the origination of a new idea) and innovation (the commercial application of a new idea). Schumpeter argues that inventions by themselves have little economic effect. For inventions to be significant, someone with the special talent for seeing their economic potential and bringing them into use must come along. That person is the entrepreneur. According to Schumpeter, once the innovator has demonstrated the profitability of his venture, more entrepreneurs enter the economic system in clusters. Schumpeter argues as if the construction of new plant and equipment was undertaken by new firms, and also argues that the development of the new firm is usually associated with the rise to business leadership of New Men. In this way, Schumpeter's theory predicts that an increase in the number of entrepreneurs leads to an increase in economic growth. Consequently, in Schumpeter's system, the supply of entrepreneurship is the ultimate determining factor of the rate of economic growth.

Schumpeter's theory of economic growth, although influential, is largely descriptive. It is not set up as a refutable hypothesis and it is difficult to formalise econometrically, with entrepreneurship consequently missing from most empirical models explaining economic growth. So Wong *et al*. (2005) note that although a great deal has been written on how entrepreneurship affects the economy (for example, Porter, 1990; Baumol, 1993; Lumpkin and Dess, 1996), there is a dearth of evidence based on empirical data. In part, this is attributable to the difficulty in defining the role of the entrepreneur (as noted above) and the difficulty in measuring and operationalising entrepreneurial activities. The work of the Global Entrepreneurship Monitor (GEM) has served to close this gap somewhat by providing empirical data on entrepreneurship as a process of forming new businesses (www.gemconsortium.org/).

It is new business creation that has typically been associated with entrepreneurship in the empirical literature. Small firms, as opposed to large firms, are often regarded as driving innovation, usually because the small firm population contains new entrants. However, as reported by the UK's Department of Business Innovation and Skills (BIS, 2011, p.97), very few SMEs undertake R&D activities. SMEs perform less innovation than large firms across a range of dimensions covering product innovation, process innovation, non-technological innovation, new-to-market product innovations and collaboration in innovative activities. These kinds of performance outcomes are identified by Shane (2009) to counter the conventional view of policy makers that creating more start-up companies (i.e. encouraging more people to become entrepreneurs) will transform depressed economic regions, generate innovation and create jobs. Shane (2009, p.142) points out that to obtain more economic growth by having more start-ups, new companies would need to be more productive than existing companies. However, the evidence indicates that they are not. Shane cites Haltiwanger *et al*. (1999), who combined data from the US census and other sources to examine

the relationship between firm productivity and firm age. Their results show that firm productivity increases with firm age. This means that (at least in the United States) the average new firm makes worse use of resources than the average existing firm. As Shane notes, this is not what you would expect if economic growth benefits more from the creation of new firms than from the expansion of existing ones. Moreover, it should not be concluded that the typical start-up makes up for its poor productivity when it matures: the typical US start-up is dead in five years.

In seeking the value of entrepreneurship, van Praag and Versloot (2007) examine the extent to which empirical evidence collectively and systematically substantiates the claim that entrepreneurship has important economic value. Based on a review of 57 economics and management studies that contain 87 relevant separate analyses, they examine the contribution of entrepreneurs to the economy compared with the contribution of non-entrepreneurs (larger and older firms). They conclude that entrepreneurs do not spend more on R&D than their counterparts and produce fewer patents, new products and technologies. Also, the percentage of radical innovations is lower among entrepreneurial firms. Entrepreneurs commercialise innovations to a larger extent, but score lower on the adoption of innovations than their counterparts. The relative contribution of entrepreneurs to the value of productivity levels is low. This holds for both labour and total factor productivity. The non-entrepreneurs are responsible for scale in terms of labour demand and GDP, a less volatile and more secure labour market, higher paid jobs, a greater number of innovations, and greater adoption of innovations.

It is clear from recent work that doubt exists on the ability of entrepreneurs to deliver growth more effectively than established firms, irrespective of whether entrepreneurs establish new firms or whether they engage in innovation. This signals the need for a modern understanding of the role of management in established firms in promoting economic growth.

Managers and economic growth

The previous discussion of the role of entrepreneurs and managers indicates that there is a lack of clarity over the respective division of the functions. While the function of the entrepreneur and the role of entrepreneurs in economic growth have been relatively well delineated, the same is not the case for managers. Moreover, it appears that what has been claimed for the entrepreneur in terms of generating economic growth can also be said for the function of management. As previously noted, it is not enough simply to assert that growth is a function of capital, labour and technology. There must be some element or factor which combines these in the right proportions, sets the task and sees to its accomplishment. In this section, we concentrate on management and the functions of management as contributors to economic growth, particularly drawing on the work of Harbison (1956), who was the first to develop the argument.

First, it is necessary to clarify the nature of management:

> It connotes a constellation of functions including specifically the management of risk and uncertainty, planning and innovation, co-ordination, administration and control, and routine supervision of the enterprise; it connotes also the integrated hierarchy of the persons who are primarily concerned with exercise of these functions – the managerial resources. (Harbison, 1956, p.378)

Management is therefore a broader concept than entrepreneurship; it subsumes aspects of the entrepreneurial function, in particular, the assumption of risk and uncertainty. In line with Harbison, it is possible to argue that management may be treated as any other resource, such as capital, labour or natural resources. So, it is possible to envisage investment in management in similar terms to investment in capital, and to 'think of "accumulation of managerial resources" as a concept parallel to capital formation and accumulation' (Harbison, 1956, p.368).

Economic growth can result from either the increased efficiency or increased effectiveness of management, or both. Over time, economic growth has outstripped the rate of increase of factor inputs, which indicates that there has been improved efficiency of operations. It is likely that there is room for improvement in efficiency even in the best-run companies. However, this requires deliberate action on the part of management. More output can be obtained from given plant, equipment and labour in the short run as a consequence of increased managerial effort. This will be considered further below.

Harbison (1956, pp.368–71) examines several propositions regarding management and economic growth. He argues that the more capital a firm has, the more, rather than the less, organisation (i.e. management) it needs. 'Thus an additional cost involved in investment in modern processes or labor-saving machinery is that of procuring and developing the managerial resources necessary to utilize and control it' (Harbison, 1956, p.369). The same argument is made for increases in the use of labour (and presumably also applies to increases in land), such that the principal factor determining the productivity of labour, assuming that capital and natural resources are constant, is management.

> A labor force is recruited, trained, developed and managed by the organization, and the skills and qualities of manpower probably depend more on what the organization does than on any natural or innate characteristics of labor itself. … I do not deny that some innate factors have influence on the quality of labor resources; my contention is simply that the organization which employs labor is probably the principal factor – the dominant force – in determining labor productivity with constant technology. (Harbison, 1956, pp.371–72)

Thus, it is probable that significant portions of differences in capital, labour and land productivity can be ascribed to differences in the quality of management. However, the extent to which management needs to be increased with an increase in scale of all factors has not been clearly demonstrated either theoretically or empirically: whether, for example, it must be increased more rapidly than capital plus labour in the early stages, and less so after some critical size has been reached because of growing returns to organisation. However, if any one factor is added, and the factor combination is changed, it seems evident that more management is always needed, never less. This harks back to the point noted above by Kindleberger (1965) – that management is a complement, not a substitute, in the production function.

Managers and routine innovation as the engine of growth

Despite Schumpeter's emphasis on the role of the entrepreneur, he expected the gradual supplanting of the entrepreneur by bureaucratised management, with technical change routinely produced and applied, reflecting changes in the practices in industry. 'Technological progress is increasingly becoming the business of teams of

trained specialists who turn out what is required and make it work in predictable ways' (Schumpeter, 1942, p.132). Schumpeter's (1911) earlier views celebrated the importance of individual, heroic, risk-taking entrepreneurs. His later model (Schumpeter, 1942) advanced the role of the formal, organised innovative efforts in large companies. It was during this period that the modern research laboratory became firmly established, initially in the chemical and electrical industries in Germany and the US (Dodgson and Gann, 2010, p.22).

The role of routine, bureaucratised management of innovation is core to Baumol's (2004) model of the driver of economic growth in the capitalist economy. For Baumol, it seems indisputable that innovation accounts for much of the capitalist system's enviable growth record and he argues that in key parts of the economy the prime weapon of competition is not price but innovation:

> As a result, firms cannot afford to leave innovation to chance. Rather, *managements* are forced by market pressures to support innovative activity systematically and substantially, and success of the efforts of any one business firm forces its rivals to step up their own efforts (italics added). (Baumol, 2004, p.ix)

This echoes Nelson's view (1996, p.52): 'given that its rivals are induced … to invest in R&D a firm may have no choice but to do likewise'. For Baumol (2004), the result is a ferocious arms race among the firms in the most rapidly evolving sectors of the economy, with innovation as the prime weapon. Further, there is profit to be earned by an innovating firm by licensing others – at a suitable price – to use its proprietary technology. The result is widespread cooperation among managers of different firms in the dissemination of the latest technology, and that, in turn, hastens widespread replacement of obsolete products and processes. Baumol maintains that these developments are a crucial part of the explanation of capitalism's growth accomplishments.

Baumol's (2004) point of departure is Schumpeter's (1942, p.84) observation that 'it is not [price] competition which counts but the competition from the new commodity, the new technology … competition which commands a decisive cost or quality advantage'. So, in the modern economy, pricing is not the primary competitive issue for management; rather the focus is on the redesign of current products, the development of new products, and the adoption of more productive production processes (Baumol, 2004, p.153). Consequently, it is innovation, not price setting, to which management gives priority in important sectors of the economy. Fierce competition puts management under constant pressure to avoid falling behind in industries where innovations in products and processes are prime weapons of inter-firm rivalry and it is persistently forced to do so by market competition.

Baumol's (2004, p.3) explanation for the 'growth miracle of free enterprise' runs as follows: oligopolistic competition, especially among large, high technology business firms with innovation as a prime competitive weapon, ensures continued innovative activities. Further, making innovation a regular and even ordinary component of the activities of the firm serves to minimise the uncertainty of the process. Then the decision process becomes essentially the same as that for any other form of investment. Hence, the standard theory of investment can be extended to include innovation as routine. Innovation is, as a result, increasingly an accustomed and predictable procedure. The managers of firms systematically determine the amount they will invest in the R&D process, systematically decide on the ways in which they will

interact with their rivals in this area, and systematically determine even what the company's laboratories should invent. Baumol (2004, p.30) offers evidence that firms have increasingly taken over the process of technological change, transforming it from fitful and uncertain discovery into something closer to a routine internal matter governed by the bureaucratic and managerial procedures that also control many of the other activities of the large corporation. Competitive pressures have transformed a major portion of innovation activity from an entrepreneurial to a managerial affair.

Baumol is not alone in acknowledging this shift. Following Schumpeter's recognition of the phenomenon, several observers have drawn attention to the growing share of the economy's innovations that flow in a routine manner from ongoing operations of the corporation (see Schmookler, 1957; Griliches, 1989). In industries in which rapid innovation is widespread and significant, managers have concluded that innovations cannot be left to chance; it is too risky for the management of firms to depend primarily for their new products and processes on the unpredictable efforts of independent inventors. Management is thus compelled to incorporate the generation of new techniques and new or improved products as a critical part of their daily operations. This is built into the firm's organisation as an internal, bureaucratically-controlled process, and budgeted like any other activity. Hence, returns on innovation are planned over long time periods, and decisions are made to invest if they pay back suitably over an acceptable period. Risk is managed by attempts to reduce how long it takes to develop and introduce innovation (Dodgson and Gann, 2010, p.28). In many industries, a substantial staff and facilities are largely or exclusively devoted to the creation of new products and processes, with the control of such facilities normally in the hands of managers, not entrepreneurs (Baumol, 2004, p.35).

Baumol further notes that management not only controls the magnitude of the firm's R&D activity, but often gets involved in its details. For instance, management may decide, in the normal course of its operations, which new ideas presented by the R&D division are sufficiently promising to merit further development finance and, ultimately, which should be introduced to the market, as well as when and how this should be done (Scherer, 1980, pp.408–10). Management may also frequently instruct the R&D division on what the firm needs most urgently to have invented. A menu of prospective inventions is pre-assigned to the R&D division.

Nelson (1990) is in accord with Baumol in arguing that in many cases the R&D that the management of a firm wants to be undertaken is closely tailored to the firm's own product and process technologies, and its most pressing needs (as management sees them). Nelson (1990) argues that effective R&D requires not only industry-specific, but firm-specific knowledge and the sensitivity of the R&D division to the needs of the client firm. It is difficult to specify in advance exactly the outcome of an R&D project, with the objectives often being re-specified during the course of the project. Such relationships are hard to govern by contract (Williamson, 1975, 1985; Teece, 1980). Further, in cases where process engineering or tailoring products to customer requirements are important, R&D may need to be closely integrated with production and marketing. To capture profit, a firm must also be able to identify and marshal in a timely manner the necessary production and marketing capabilities. These co-specialised assets (Teece, 1986) need to be deployed rapidly and effectively into the latent market before rivals can respond. Integration of R&D into the firm facilitates such needed coordination. Institutionally, such activities may not be clearly separated, much less contracted out (Nelson, 1990, p.199). Moreover, often

high-priority R&D projects tend to grow out of current ones and out of what is learned in operating experience. Consequently, there are advantages to a firm from durable and close bonds with the R&D division serving it.

Baumol (2004) further argues that there is profit to be earned by an innovating firm licensing others, at a suitable price, to use its proprietary technology. The result is widespread cooperation among managers of firms in the dissemination of the latest technology. This, in turn, hastens widespread replacement of obsolete products and processes. Baumol argues that such voluntary dissemination of proprietary technology is a crucial part of the explanation of capitalism's growth accomplishments. Initially, this view appears surprising because the conventional interpretation is that firms gain competitive advantage from their possession of products and processes that are unavailable to rivals (e.g. Barney, 1991). It is, therefore, expected that firms will prevent the spread of this proprietary technology. In contrast, Baumol (2004, p.75) argues that it is incorrect to depict the typical firm as a determined guardian of its technology against all use by others. Rather, there are competitive mechanisms that can make dissemination of technology a part of the regular portion of the firm's voluntary activities. Baumol shows that market forces frequently motivate firms to become active sellers of licences for the use of their proprietary technology, or to make a variety of information-exchange arrangements ranging from implicit contracts to carefully-specified legal commitments.

Similarly, Nelson (1990) concludes that divulging certain kinds of information does not significantly undermine a company's real proprietary edge. Where new products are patentable and patents are effective – as in pharmaceuticals – it does not hurt a company to publish generic information, if it gets the patent. Making generic information from R&D available for free does not handicap a firm from reaping handsomely from its product innovation, if it has a significant head start on production and marketing of the product in question, and the capacity to take advantage of the lead. Finally, there are industry-wide efficiency gains to be had by sharing technology: everyone is better off if everyone shares.

Nelson (1990) argues that, in many cases, managers do not try to block information flow, and in other cases actively support it by encouraging employees to publish, to talk at technical society meetings, etc. Managers of firms therefore buy, trade and share technological information. They also cooperate in R&D through joint venture activity, often with competing firms (Glaister and Buckley, 1996) in order to share costs, find complementary expertise, gain rapid access to different technologies and knowledge, and collaborate as part of networks often spread across several international partners.

Radical and incremental innovation

As a way of emphasising the role of management in delivering economic growth, it is useful to distinguish between radical and incremental innovation, and particularly the role of managers in promoting the latter. Despite Baumol's (2004) emphasis on technological innovation in high technology firms, it should be recognised that innovation occurs in all sectors of the economy (see Dodgson and Gann, 2010, p.15). Moreover, most innovations are incremental improvements – ideas used in new models of existing products and services, or adjustments to organisational processes. Innovations described as 'continuous improvement' tend to be routine and highly incremental in nature, such as an improvement in the fuel efficiency of a car

engine. These small improvements are cumulatively important, but tend to be neglected in the literature.

In contrast, radical innovations change the nature of products, services and processes, for example, the development of synthetic materials, such as nylon. According to Baumol (2010, p.35), individual inventors and entrepreneurs provide a disproportionate share of breakthrough discoveries, with large established firms providing streams of incremental improvements that also add up to major contributions. Drawing on this distinction, Acs *et al.* (2009) develop a model where new product innovations can come from either incumbent firms or start-ups. They see incumbent firms as reliant on incremental innovation from the flow of knowledge, such as product improvements, while start-ups with access to entrepreneurial talent and 'intra-temporal spillovers' from the stock of knowledge are more likely to engage in radical innovation leading to new industries or replacing existing products. In essence, they argue that if an incumbent firm decides the expected economic value of a new idea is not sufficiently high to warrant its development and commercialisation, other economic agents may assign a higher expected value to the idea. This divergence in expected valuation can lead to market entry by economic agents to appropriate new knowledge. Note that the knowledge that induces the decision to start new firms is generated by investments made by an incumbent firm. Consequently, the start-up serves as the mechanism through which knowledge spills over from sources that produced it (such as an incumbent firm) to a new organisational form where it is commercialised. Acs *et al*. (2009) make the strong assumption that radical innovation comes from new firm start-ups.

At the highest level, there are rarer periodic transformational innovations, which are revolutionary in their impact and affect the whole economy; for example, Boulton and Watt's development of the steam engine, the transition from horse-drawn transport to the internal combustion engine, Edison's development of electric power generation technology, Gates's development of software. Transformational innovations are what Schumpeter is essentially referring to in his earlier work. However, these are highly exceptional examples. Such revolutionary innovations are also referred to as general purpose technologies (see Lipsey *et al*., 2005).

As noted, most innovation is incremental/radical rather than transformational – and a normal part of management in many different kinds of sectors. Indeed, the historical record indicates that much of an economy's productivity growth is attributable not only to dramatic breakthroughs, but perhaps even more to the accumulation of small improvements and minor technical modifications of pre-existing products and processes (Rosenberg, 1982, pp.62–70). Mokyr (1989, p.28), in discussing technological change during the Industrial Revolution in Britain, states that 'Technological change and inventive activity were by no means identical. The cumulative effect of small improvements made mostly by anonymous workers and technicians was often more important than most of the great inventions'. McCloskey agrees (1989, p.66): '… contrary to much thinking on the matter, innovation was widespread. The Industrial Revolution was not the age of Cotton or of Railways or even of Steam entirely; it was an age of improvement'. As Blaug (1999, p.110) has observed, '… innovations are rarely the dramatic breakthroughs that Schumpeter may have had in mind but rather small improvements in a new process or product in which genuine novelty and imitation-with-a-difference shade imperceptibly into one another'. This sort of

improvement is most typically provided by corporate R&D activities. An economy's routine R&D investment, instigated and controlled by the managers of firms, contributes materially to economic growth.

Management matters

If management makes a contribution to economic growth, then a necessary prerequisite is that management makes a difference to the productivity performance of firms. In others words, management must matter. Management, however, is not homogeneous and some firms will be managed in ways that have a more beneficial impact on growth than others. This also implies that management is capable of improving and raising its performance level to the benefit of economic growth, which in turn raises questions about how this may be achieved.

Empirical studies show that there are very large differences in productivity across both firms and countries (Foster *et al.*, 2008; Hsieh and Klenow, 2009). An obvious explanation for these productivity differences lies in variations in management practices. Although there is a paucity of empirical evidence specifically bearing on this matter, some early studies of firm productivity included management in their set of explanatory factors (e.g. Lieberman *et al*., 1990). More recently, research has identified the importance of management. For instance, Nallari and Bayraktar (2010), with data from 45 developing countries obtained from the investment climate surveys of the World Bank, find that productivity at the micro level is driven by research and development, the capacity utilisation rate, and adoption of foreign technology, all of which involve management decisions, although management is an unmeasured input. More concretely, Bloom *et al*. (2012), report a regression of gross domestic product (GDP) *per capita* on management practices across 17 countries that yields an *R*-squared of 0.81.

Nevertheless, as Bloom *et al*. (2013) note, generally economists have been sceptical about the importance of management. One reason for this scepticism is the belief that profit maximisation will lead firms to minimise costs (e.g. Stigler, 1976). Consequently, variations in management practices will reflect firms' optimal responses to different market conditions. For instance, in low wage economies firms may prefer to repair existing equipment rather than invest in the latest machine tools. This indicates that their management practices are not bad, but rather the optimal response to low wages (Bloom *et al*., 2013, p.2). Another reason for scepticism is the complexity of management, which makes it hard to measure.

The upshot is that research by economists has given little consideration to the question of how much individual managers matter for firm behaviour and economic performance (Bertrand and Schoar, 2003). Typically, empirical studies have relied on firm-, industry- or market-level characteristics to explain corporate behaviour and performance, largely ignoring the role that individual managers might play in shaping these outcomes. In part, this has been because of the absence of high-quality data on managers and management practices measured in a consistent way across countries and firms. Also responsible are the many studies that implicitly assume a neoclassical view of the firm in which top managers are homogeneous inputs to the production process (Bertrand and Schoar, 2003, p.1173), and managers are regarded as perfect substitutes for one another. A more extreme assumption is that top managers do not influence what goes on within the firm, because a single person cannot

easily affect corporate policies. Either assumption means that individual managers do not matter for corporate decisions.

Bloom *et al*. (2013) point out, however, that recent research has focused on specific management practices which can be measured. They find large variations across establishments and a strong association between these practices and higher productivity and profitability (Bloom and Van Reenen, 2011; Lazear and Oyer, 2012). Bloom and Van Reenen (2007) examine management practices and firm-level productivity with data from 732 medium-sized firms in the United States, France, Germany and the United Kingdom. They observe a considerable spread in management practice, with a large number of firms appearing to be extremely badly managed, with ineffective monitoring, targets and incentives. They also find that better management practices are significantly associated with higher productivity, profitability, Tobin's Q, sales growth rates and firm-survival rates.

Bloom *et al*. (2013) further examine the question of whether management matters by running a management field experiment. The experiment took large, multi-plant Indian textile firms and randomly allocated their plants to treatment and control groups. Treatment plants received five months of extensive management consulting from a large international consulting firm. The control plants received only one month of diagnostic consulting. The treatment intervention led to significant improvements in quality, inventory, productivity and output. The better-managed firms also spread these management improvements from their treatment plants to other plants they owned, providing further evidence of their beneficial impact. In a recent study, Helper and Henderson (2014) analyse the decline of General Motors (between 1980 and 2009, GM's US market share fell from 46% to 20%, and in 2009 the firm went bankrupt) and identify the cause of GM's failure as its inability to adopt the managerial practices that enabled its Japanese competitors – particularly Toyota – to introduce cars of much higher quality and much better design.

In related work examining managers (rather than management practices), Bertrand and Schoar (2003) investigate whether and how individual managers affect corporate behaviour and performance by constructing a manager–firm matched panel dataset allowing them to track individual top managers across different firms over time. They find considerable heterogeneity across managers and that the attainment of all investment, financing and other organisational strategy variables appears to depend on the specific executives in charge. They also find that the heterogeneity in investment, financial and organisational practices of firms can be explained to a significant extent by the presence of manager-fixed effects, identifying specific patterns in managerial decision making that appear to indicate general differences in 'style' across managers.

In summary, differences in the quality of management and the adoption of different management practices help explain differences in output among firms. In turn, improvements in the quality of management and management practices may explain why growth proceeds faster than is accounted for by factor inputs (Kindleberger, 1965, p.132). The fact that efficiency levels vary among firms implies that the discovery and dissemination of new and best management practices are important. For instance, Bloom *et al*. (2013) conclude that firms were not implementing best practices on their own because of lack of information and knowledge, suggesting that training programmes for basic operations management and demonstration projects could be helpful. Birkinshaw *et al*. (2008) stress the importance of new management practices intended to further organisational goals (i.e. the innovation of management

in order to further firm success). This discussion also highlights the role business schools can perform in identifying and disseminating best management practice in order to improve the efficiency and effectiveness of managers as a way of promoting economic growth (Thorpe and Rawlinson, 2013).

Conclusions

Standard neoclassical models of growth present an autonomous process with no role for managers. A weakness of endogenous growth models is that decisions affecting innovation are not explicit, with the mechanism and the process responsible for growth inferred indirectly. Baumol (2004), in contrast, has developed a model of endogenous innovation which deals explicitly with the way in which economic forces direct the economy's innovation activities. Baumol emphasises the role of routine, bureaucratic innovation which has become a normal and fundamental part of management activity, and as such emphasises the importance of management for economic growth.

In the development of the literature, the contribution to economic growth of the entrepreneur has been highlighted, and the contribution of managers neglected. While the entrepreneur has undoubtedly made a major contribution to capitalist growth, this paper argues that in the modern economy there are limits to the delivery of economic growth through the establishment of new firms or radical innovation from sole entrepreneurs. It argues that management makes a significant contribution to economic growth, in terms both of ensuring the efficient use of factor inputs and of being effective in driving innovation. While it is useful to distinguish between the functions of the entrepreneur and those of the manager, it should be recognised that the two are aligned, and what traditionally has been presumed to be the role of the entrepreneur should also be seen as the role of the manager. Although management is a broader concept than entrepreneurship, it may be argued that much of what has been termed 'entrepreneurship' can in fact be viewed as normal management activity.

Innovation, as the fundamental source of economic growth, clearly depends on an array of management skills. There is, however, a dearth of research on the management skills and practices necessary to provide more output from given inputs, and to promote innovation and thereby economic growth. Further research is required which involves asking questions about factor use and not just about factor accumulation (Crafts, 1992). Where management practice provides a dynamic force producing economic growth, it is necessary to examine this driving force at the level of the firm. This will involve amassing data at the firm level and extracting the maximum amount of insight (Harberger, 1998). It should be clear that a more careful examination of the role of management has the potential to make a real contribution to our understanding of the determinants of growth (Stern, 1991), and particularly to developing best management practice as a normal part of management activity. Rather than simply emphasising the importance of the small business sector as the cradle of growth and seeing innovation as simply the product of the heroic entrepreneur, it would be more realistic to recognise the routine role of managers in generating economic growth.

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Note

1. Solow and Temin (1989, p.80) note that 'the appropriate measure of the contribution of a particular input to the average annual rate of growth of output is given by the product of the average annual rate of growth of the input, and the elasticity of the output with respect to that input. To ask whether the growth of productive inputs "explains" the growth of output is simply to ask whether the sum of such products is equal to the rate of growth of output itself'. The excess of the rate of growth of output over the sum of these products is termed the 'residual'. A positive residual, therefore, reflects an increase in the productivity of the economic system. Possible sources of the residual are increasing returns to scale, improved efficiency in the allocation of resources (transfer of resources from low-productivity employment to high-productivity employment; for example, from agriculture to industry), and technological progress (Solow and Temin, 1989, p.93). The main emphasis in the literature has been on technological progress.

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