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Entrepreneurs, Inventors and the Growth of the Economy

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About the Report: The Conference Board has recently undertaken a project on innovation and competitiveness, with funding from Microsoft Corporation. The goal of the project is to provide an overview of the current state of knowledge on the nature of innovation, and its role in stimulating economic growth and improved living standards in the U.S. The project draws on experts across the academic, corporate, and policy arenas, in addition to The Conference Board's own analysis, surveys, and focus groups of the business community. Such experts met in February 2007 to present and discuss various aspects of the innovation process and measurement thereof. Each presenter wrote a summary piece focusing on his respective area of expertise. These summary documents underpin the content in *Innovation and U.S. Competitiveness*; however the conclusions drawn are those of The Conference Board alone. These papers are retained for reference in The Conference Board Economics Program Working Paper Series.

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Entrepreneurs, Inventors and the Growth of the Economy

William J. Baumol[1]

To borrow from Mark Twain, all economics textbooks talk about the importance of entrepreneurship, but none of them says what we should do about it. Yet, there are good reasons to conclude that entrepreneurship makes two critical contributions to economic well-being: First, entrepreneurship stimulates growth by putting innovation to work and, second, it provides an avenue for the reduction of poverty. In this article, I discuss the processes that underlie these conclusions, but I also offer a crucial caveat that will at the same time demonstrate that there is no guarantee that entrepreneurial activity will always produce these beneficial results. However, the *caveat* will offer a handle for the design of appropriate policy.

Preliminary: A Bit of Classification

To facilitate the discussion of the issues just listed, it is necessary to recognize that entrepreneurs come in different forms, working in different ways and, therefore, their activities have different consequences for the economy. It is therefore helpful to begin with two simple classificatory subdivisions that enable us to focus on these matters more easily. The first and most obvious subdivision is between what I label "replicative" entrepreneurs and "innovative" entrepreneurs. Generally, entrepreneurs have been defined as individuals who create a new firm or some other economic organization or

[1] Paper prepared for the Conference Board's Workshop Perspectives on U.S. Innovation and Competitiveness, February 8 and 9, 2007. Contact Author: William Baumol, Harold Price Professor of Entrepreneurship and Academic Director, Berkley Center for Entrepreneurial Studies, Stern School of Business, New York University; and Joseph Douglas Green, 1895, Professor of Economics Emeritus and Senior Economist, Princeton University.

who launch some economic activity that they will carry out at least initially. A replicative entrepreneur is someone who organizes an enterprise of a variety that has been launched many times before, and of which many other examples are currently extant—e.g., a new retail shoe shop or another limousine service. Replicative entrepreneurship has proven its effectiveness as a way out of poverty, as dramatically illustrated by the immigrant peddlers who often ended up sending their children to college.

The innovative entrepreneur, as the name implies, does something that has not been done before. She may market a new product, or may sell licenses to other firms to make use of intellectual property in her possession, the specifications of new products, or new production processes. But she may innovate in other ways as well, for example, recognizing new uses for an old product or a new market for that item, or a novel and more efficient way to organize the firm. Indeed, I will note presently that the options available to the innovative entrepreneur are much broader than that. This is important because it is the innovative entrepreneurs who are the key to economic growth, since it is they, rather than the replicative entrepreneurs, who ensure that invention is put to effective use. Without innovative entrepreneurs, the innovations that promise rapid economic growth have been left to languish. But such an outcome can be prevented only if the prevailing economic forces provide the incentives for the innovative entrepreneurs to carry out the necessary activities.

The second way in which we will find it useful to classify entrepreneurs focuses on the fact that, contrary to what might at first appear to be true, not all entrepreneurial activities are inherently beneficial to society. The fact is that entrepreneurs, like lawyers or professors, are not archangels and can differ markedly in the ethics of their behavior.

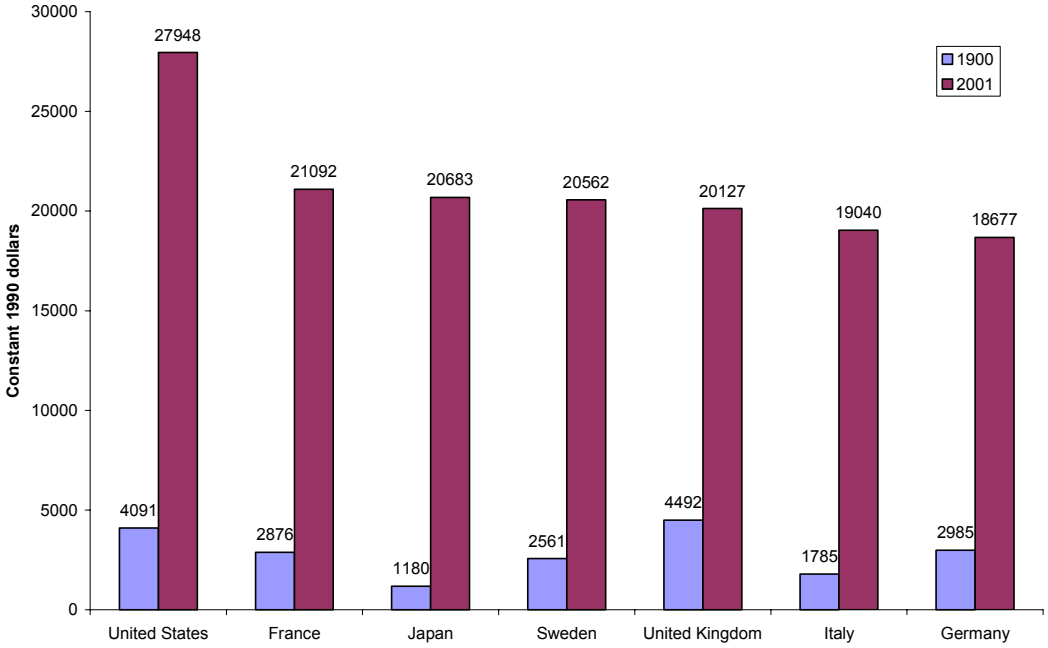
The organizer of a narcotics ring can be as enterprising and business-oriented as the creator of a firm that markets a very valuable piece of software. The entrepreneurs in a society in which corruption is virtually the only way to wealth can and do find very enterprising ways to achieve positions in which they can acquire a share of the benefits. In our society, despite the jokes at their expense, lawyers contribute materially to efficient functioning of the economy. But there are other attorneys who are enterprising in finding ways, for example, to misdirect the antitrust laws in order to shield their clients from effective competition. I will show here that the ethical posture and the degree of benefit of entrepreneurs' activities to the society are very heavily influenced by current social institutions and legal structure, suggesting immediately that this is a matter that merits the attention of those in government who design economic policy.

The Astonishing Accomplishment and the Entrepreneur's Contribution

Although most of us are well aware of the fact that there has been significant economic progress since the inception of the eighteenth-century Industrial Revolution in the United Kingdom, few if any of us have grasped its magnitude. Figure 1 reports Angus Maddison's very conservative estimate of what has been accomplished in only one century (Maddison, 2003). It is conservative because other estimates of the magnitude of growth are higher, some substantially so. Table 1 provides numerical indications of the magnitudes entailed. To take only one example, it concludes that over the course of the twentieth century, per-capita income in the U.S. rose nearly sevenfold. In contrast, in the approximately thirteen centuries between the fall of Rome and the Industrial Revolution, the rise in real per-capita income was probably close to *zero*. To grasp what is entailed in

a seven-fold expansion of real income, readers should imagine that they currently receive the income of an average American and that, suddenly, six out of seven dollars are magically removed from their wallets, their bank accounts and all of their other assets. How would their life styles adapt? One must surely admit that it is difficult to imagine.

Figure 1
Real Per-Capita GDP, 1900 vs. 2001, Seven Successful Economies



Source: Maddison, 2003.

Table 1
Rise in Real Per-Capita GDP, 1900-2001

	% Rise	Multiple
United States	**583%**	**6.83**
France	**633**	**7.33**
Japan	**1,653**	**17.53**
Sweden	**703**	**8.03**
United Kingdom	**348**	**4.48**
Italy	**967**	**10.67**
Germany	**526**	**6.26**

Source: Maddison, 2003.

The Crucial Role of the Entrepreneur in the Unprecedented GDP Explosion

We can infer from all this that the magnitude of the rise in GDP in the past two centuries been unprecedented in human history, and unimaginable by our ancestors. But what is the relation of all this to the entrepreneur? That is, what is his role in all of this growth? The answer derives from the fact that what evidently underlay the Industrial Revolution is what one historian called the "wave of gadgets," the steam engine, the railroad and all the other inventions that came forth *and were put to productive use*, beginning at the end of the eighteenth century. As already suggested, entrepreneurs are often not inventors, but it is they who see to it that a promising invention is not neglected and forgotten, as happened in so many cases in the age of great invention in China, or more recently in the Soviet Union, where its superbly educated scientists and engineers

contributed a surprising abundance of innovative technology, most of which was never put to use if it had no evident military purpose.

The mostly forgotten story of the steam engine brings the point out dramatically. Contrary to what is widely believed, the steam engine was not invented by James Watt—what he contributed was a critical improvement. But the steam engine had even been invented well before Newcomen, whose engines were to be found throughout England when Watt began his work. The first engine of which we are aware was contributed by Heron of Alexandria, probably in the first century CE. The relevant point was made by Abraham Lincoln, not long before he became president:

> "…as much as two thousand years ago the power of steam was not only observed, but an ingenious toy was actually made and put in motion by it, at Alexandria…." What appears strange is, that neither the inventor of the toy, nor anyone else, for so long a time afterwards, should perceive that steam would move *useful* machinery as well as a toy" (Lincoln, 1858).

The problem was that, during the ascendancy of Rome, wealth-seeking enterprise was respectable, but only if it contributed nothing to production (other than in agriculture). Aggressive warfare, ransom, bribery, usury and other such activities were deemed commendable, but productive enterprise was left to freedmen (manumitted slaves) and their sons. So the water wheel was considered a gadget that merited only passing notice as a minor piece of technology and was, so far as we know, used only to

mill grain and not, as in the later Middle Ages, to saw lumber, hammer metal, prepare cloth and so on and on.

In the case of the steam engine, Watt had an energetic and creative entrepreneur partner, Matthew Boulton. It was he, not Watt, who recognized the use of the steam engine to run things such as cloth-making machines and transport engines. But so far as we know, Heron had no productive entrepreneur partners, so his invention remained a toy, forgotten like the fabulous Chinese inventions of the Tang and Sung dynasties.

Clearly, the role of the entrepreneur is critical for effective innovation and growth. Today, a primary task of the innovative entrepreneurs is alertness for opportunities to introduce new products or processes, new uses for extant products, new methods for putting them to use, new markets that will be receptive to them, and so forth. Sometimes the inventor and the entrepreneur are the same person. In other cases, they are partners, or the entrepreneur may purchase the intellectual property from its creator. The variety of the arrangements in which the entrepreneur engages is enormous. But there is one universal attribute of her role. She is, in effect, the middleman between the inventor and the ultimate user of her invention.

And, indeed, the small entrepreneurial firms of the United States have been the source of an astonishing proportion of the radical inventive breakthroughs of the past two centuries. Table 2 provides a representative list, which indicates that, although large enterprises—with their huge R&D establishments—have provided the bulk of the expenditure and the bulk of the improvements up to the stage of user-friendliness of the new items, it was often the independent inventor and her entrepreneur partner who contributed the breakthrough ideas.

Table 2. Some Important Innovations by U.S. Small Firms in the Twentieth Century

Air Conditioning	Heart Valve	Portable Computer
Air Passenger Service	Heat Sensor	Prestressed Concrete
Airplane	Helicopter	Prefabricated Housing
Articulated Tractor Chassis	High Resolution CAT Scanner	Pressure Sensitive Tape
Cellophane Artificial Skin	High Resolution Digital X-Ray	Programmable Computer
Assembly Line	High Resolution X-Ray Microscope	Quick-Frozen Food
Audio Tape Recorder	Human Growth Hormone	Reading Machine
Bakelite	Hydraulic Brake	Rotary Oil Drilling Bit
Biomagnetic Imaging	Integrated Circuit	Safety Razor
Biosynthetic Insulin	Kidney Stone Laser	Six-Axis Robot Arm
Catalytic Petroleum Cracking	Large Computer	Soft Contact Lens
Computerized Blood Pressure Controller	Link Trainer	Solid Fuel Rocket Engine
Continuous Casting	Microprocessor	Stereoscopic Map Scanner
Cotton Picker	Nuclear Magnetic Resonance Scanner	Strain Gauge
Defibrillator	Optical Scanner	Strobe Lights
DNA Fingerprinting	Oral Contraceptives	Supercomputer
Double-Knit Fabric	Outboard Engine	Two-Armed Mobile Robot
Electronic Spreadsheet	Overnight National Delivery	Vacuum Tube
Freewing Aircraft	Pacemaker	Variable Output Transformer
FM Radio	Personal Computer	Vascular Lesion Laser
Front-End Loader	Photo Typesetting	Xerography
Geodesic Dome	Polaroid Camera	X-Ray Telescope
Gyrocompass		Zipper

Source: U.S. Small Business Administration, 1995, p. 114.

The Entrepreneur as Re-Allocable Input

The role of institutions in influencing the supply of entrepreneurs is, of course, not a new observation, and has been emphasized by a number of authors, notably Douglass North (see North and Thomas, 1973, and North, 1990). What may be new is the assertion that institutional changes do not do this primarily by inducing creation of a body of new entrepreneurs where there were few before, but by enticing enterprising individuals away from their previous unproductive activities and leading them to transfer to productive undertakings. In a personal communication, Richard Sylla gives a striking example of this critical conclusion: “Meiji Japan… reformers commuted peasant rice

payments to Samurai into government bonds, giving the Samurai government bonds and taxing the peasants in money to pay interest on the bonds. The Samurai were encouraged to become investors… and bankers… and Japan with a modern financial system suddenly left the rest of Asia in the dust and caught up with the West. The Samurai leaving fighting and becoming bankers must surely be a classic example of an institutional change enticing enterprising individuals away from previous unproductive activities and leading them to transfer to productive undertakings."

The critical conclusion here is not that entrepreneurial activity can be reallocated by changes in the structure of incentives from one field of activity, from one industry to another. That any observer can recognize. The new insight is that some of those activities, indeed throughout much of history, many of those activities, have been unproductive or even seriously damaging to the general welfare. The prototype is the entrepreneurial leader of a private army and we have just seen a number of other examples, some of them even rather innovative. Of course, in our society and most of the other industrialized countries some of the most blatant forms of unproductive entrepreneurship have been contained or eliminated. But in more impoverished societies, such as many in Africa or Latin America, enterprising corruption continues to be a hallmark of the way of life. It entails activity that is widespread, expected and even respected, and means that the persons with entrepreneurial capabilities are attracted to the associated role and away from the economy's productive opportunities. The result is that production lags, production methods are confined to the traditional and do not take advantage of more powerful and more modern approaches, and the society is mired in poverty. The resulting

network of corruption even nullifies well-intentioned attempts from other societies to provide aid to these impoverished lands.[2]

In addition, the misallocation of entrepreneurship can and often does result from government action. Often such action is driven by vested interests, as when in the Middle Ages the London fullers petitioned the king to prohibit local cloth makers from using the more efficient water mills that the absence of rushing waters in the big city denied to urban producers. But efforts to use the law to undermine competition are hardly confined to ancient history. For example, British providers of older forms of transportation succeeded in inducing the law to introduce various handicaps that impeded the use of the automobile:[3]

> "…A British law of 1865 required that there be at least three people driving every motorized vehicle, in addition to a walker with a flag who had to precede the 'locomotive' by sixty yards to warn those ahead and calm frightened horses; that the speed be limited to four miles per hour in the country and two miles per hour in populated areas…among other constraints" (Landes, 2006, p. 112).

Such public sector interventions are apt to be accompanied by severe handicaps to productive entrepreneurial activity:

> "It takes two days to start a business in Australia, but 203 days in Haiti and 215 days in the Democratic Republic of Congo….Employment laws

[2] There is a hypothesis in the sociological literature that the corruption is ascribable to poverty and is enforced by it, rather than the other way around. The argument is that in such an economy, because the opportunities for viable occupations are so scarce, social pressure forces those in control to give priority to family members and other kin in offering jobs or other opportunities. This leaves no option to other members of the society, who have no relatives in power, to do the only thing they can: They are forced to offer bribes to those in control as the only way to get a chance at the few available opportunities. See Granovetter, forthcoming..

[3] For more recent examples in the U.S. courts, see Baumol, 1993, Chapter 4.

in Salvador allow fixed term contracts only for specific jobs and set their duration to be at most one year…." (quoted in Friedman, 2005, p. 320).

But perhaps the most daunting of such counterproductive interventions are those that have resulted from misguided attempts at virtuous action by the authorities. There may be elements of this in the example just given, but India provides some of the most striking illustrations. For example, I am informed that until a few years ago, in India, a substantial number of industries, including the manufacture of automobile parts, were reserved for small firms, strictly limited to small investments. Moreover, in other industries, firms were required to provide estimates of their production the following year, and outputs in excess of these amounts were subject to severe penalty. In the insurance industry there were legal restrictions on the use of computers. These provisions were evidently adopted by idealists seeking to protect jobs, small enterprises and competition. The result was incredible poverty that began to be rolled back (and allowed India to achieve striking growth) only when these regulations were weakened or eliminated and the market received some freedom, changing the structure of the incentives offered to entrepreneurs. Clearly, here is a striking case of poverty preserved by a misguided program that was meant to contribute to its elimination.

Threats to Enterprise in the West

We in the United States must not be smug, however. The West is still vulnerable to the same disease. I have already cited some examples, provided by me elsewhere. These examples entail enterprising efforts by relatively inefficient firms to subvert the courts and the antitrust authorities into granting them protection from the too-effective

competitive activities of more efficient rivals. In the cases I cite, the attempts were fortunately rejected by the courts, but that is a biased sample, because cases in which the attempt succeeded are not easily to identify in the records. One can be confident that they exist in abundance, that the resources misdirected by these activities are hardly negligible, and that the results are likely to be the erection of impediments to innovative entrepreneurial efforts, which are apt to be mischaracterized as efforts undertaken only to destroy rivals. The antitrust laws themselves, of course, were intended to protect the general welfare by safeguarding competition, but the result, all too often, can be the reverse.

Another example of misguided rules and regulations is the case of a large, centrally located office building in London that remained empty and unused for many years after its completion. This bizarre manifestation has been ascribed to British rent control laws adopted to protect tenants from exploitation. Because of the inflexibility of the regulations, the empty skyscraper became another of many examples of landlord reluctance to rent, for fear of being kept to rent levels that inflation could easily transform into confiscatory arrangements. A similar perverse outcome has been held responsible, in part, for high unemployment levels in Europe, where in a number of countries new employees are rapidly granted job tenure so that, if their performance later turns out to be unsatisfactory or their employer experiences some financial difficulties, the employees can be dismissed afterwards only with enormous difficulty. At the same time, this practice discourages prospective entrepreneurs from leaving their tenured jobs and undertaking the risks entailed in creating new enterprises. To this, a number of observers have ascribed the relative sparseness of new firm formation in Europe. I could easily cite

other examples, but the point should already be clear: We inhabitants of the industrialized countries still have open to us an abundance of opportunities to change the "rules of the game" in a way that facilitates and encourages entrepreneurship and thereby strengthens the foundation that underlies growth.

Concluding Comment

Economics is an arena in which common sense is often a useful, and sometimes reliable, guide. But every once in a while common sense can betray us and, despite the decision maker's best intentions, lead us to do grievous harm to those we are most anxious to help. The poor are most frequently the victims of such misguided intentions, and misdirection of entrepreneurial activity is often the means by which the damage is inflicted. In restricting the introduction or exercise of entrepreneurial activities, we are likely to be driven by an intention to protect the interests of their customers and their employees. But, in the process, we are all too likely to close down or place obstacles in the road out of poverty and to handicap innovation and growth, which are the most promising of all developments for promotion of the general prosperity.

My appeal is not for neglect of the world's poor and unfortunate, or for failure to extend aid to them when the need for such assistance is urgent. Rather, my goal is the opposite. For their sake, I appeal for the thoughtful determination of steps that really will help them and will do so in an enduring way, rather that doing that which enables us to congratulate ourselves on our personal virtue, but which makes little difference in the long run for those most in need of effective support.

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