

# Towards Microeconomics of Innovation: Growth Engine Hallmark of Market Economics

WILLIAM J. BAUMOL\*

## Abstract

The Bourgeoisie (i.e., capitalism) cannot exist without constantly revolutionizing the instruments of production. Conservation of the old modes of production in unaltered form was, on the contrary, the first condition of existence for all earlier industrial classes. The bourgeoisie, during its rule of scarce one hundred years has created more massive and more colossal productive forces than have all preceding generations together. It has accomplished wonders far surpassing Egyptian pyramids, Roman aqueducts and Gothic cathedrals...[Marx and Engels, 1847].

Baumol's Second Tautology: Innovation is a heterogeneous product.  
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## The Big Puzzle: Why Do all Rival Systems Trail so Far Behind Free-Market Growth?

Per-capita income in the leading capitalist economies is growing at a rate that apparently permits something like an eight-fold multiplication in a century, as Keynes predicted in 1932.<sup>1</sup> I suggest this number is so large that it defies comprehension. What would our lives be like if we were recipients of an average family income today, and then seven eighths of that amount were suddenly removed? In contrast, it is estimated (very crudely, of course) that in wealthy eighteenth century England real per-capita income had just about re-attained its level in third-century Rome, some 15 centuries earlier. Words do, indeed, fail in an attempt to convey the incredible growth record of the free-market economies. Undoubtedly, the spectacular and unmatched growth rates of the industrialized free-market economies are what distinguish them most from all other economic systems. In no other system, current or in the past, has the average income of the general public risen anywhere nearly as much or as quickly as it has in North America, Western Europe and Japan. Though the Soviet Union planned its economy and forced its population to invest heavily in factories and hydroelectric dams, its failure to produce enough to raise the standard of living of its population to that of the free-market economies undoubtedly played a major role in its downfall. There have been great civilizations with extraordinary records of invention and engineering—medieval China and ancient Rome are clear examples. But none has approached the growth record of modern free-market economies. What is the secret of their extraordinary success? That is the economic puzzle that undoubtedly is critical to the degree of prosperity our future is

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able to achieve. Its answer is what the world's poorer countries are anxious to learn. Yet in the theoretical growth literature there is hardly anything said about the differences between the economics of capitalism and all rival economic systems that can account for the totally unprecedented performance of the former.

In informal attempts to explain the miracle, the terms innovation and entrepreneur frequently recur. Yet in the main body of our writings on microeconomic theory these two words are also scarcely to be found.

The explanation of this miracle must surely be sought in the activities of industries and the business firms of which they are constituted. For they are the producers of the increasing outpouring of goods and services that constitutes the growth record of capitalism. It must be something about business firms and the decisions they make that plays a vital part in the this prime accomplishment of our economy. But the standard microeconomics of firms and industries, while it has included some outstanding contributions on the theory of innovation, has provided little suggesting what features of business behavior and decision making can account for all this growth. Indeed, as we know, standard welfare theory offers reasons to expect the contrary—that the capitalist economy will be characterized by levels of innovation activity that are far from optimal.

Here, I will describe some features of competitive markets to which the growth performance of business firms can be attributed, features that literally force businesses to do all they can to contribute to the growth miracle. I will then provide some hints of a microeconomic model using the most elementary of microeconomic tools, to analyze this process.

### **Microeconomic Models of the Firm: Where is the Entrepreneur?**

The Schumpeterian entrepreneur is a widely respected concept, but in formal theory he is an invisible man. Virtually all theoretical firms are entrepreneurless.<sup>2</sup> It is not difficult to explain the absence. There are at least two reasons. The first is the extreme lack of standardization in innovation, the product of the entrepreneur's activity. The second is the use of maximization and minimization as the theorist's central descriptive tool.

Economic theorists have always found it difficult to deal mathematically with heterogeneous products, though there has recently been considerable progress here. But innovation is perhaps the product that attains the ultimate in lack of uniformity. If two products or processes are very similar they will not both be considered innovative. Innovative activity, by definition, is the attempt to introduce something that did not exist before. The result is that it becomes virtually impossible to say anything at all that characterizes the features of every innovation. That already is an enormous handicap for the theorist, even for one who acknowledges a key role in the growth process for the entrepreneur as innovator.

The second obstacle to incorporation of the entrepreneur into the standard theory is the nature of the generic model of the firm. In its simplest form (and in this respect the more complex and more sophisticated models are no better), the theoretical firm must choose among alternative values for a small number of rather well-defined variables: price, output, investment, perhaps advertising outlay and, occasionally, a few others. In making this choice management is taken to consider the costs and revenues associated with each candidate set of values, as described by the relevant functional relationships, equations, and inequalities. Explicitly or implicitly, the firm is then taken to perform a mathematical calculation which yields optimal (i.e., profit-maximizing) values for all of its decision variables and it is these values that the theory assumes to be chosen—that are declared by the theory to constitute the company's vector of decisions. There matters rest, forever or until exogenous forces

lead to an autonomous change in the environment. Until there is such a shift in one of the relationships that define the problem, the firm is taken to replicate precisely its previous decisions, day after day, year after year.

Clearly, the entrepreneur has been read out of the model. There is no room for enterprise or initiative. The management group is left in control and yet becomes a passive calculator that reacts mechanically to changes imposed on it by fortuitous external developments over which it does not exert, and may not even attempt to exert, any influence.

What has just been said constitutes no criticism, not even an attempt to reprove mildly the neoclassical model of the firm. That model does what it was designed to do and does it well. Like any respectable analysis, one hopes that it will be modified, amended, and improved with time, but not because it is incapable of handling an issue for which it was not designed. The model is essentially an instrument of optimality analysis of well-defined business decision problems, and it is precisely such (very real and important) problems that need no entrepreneur for their solution. Rather, he is needed for assistance in accounting for the free-market's growth performance. I will return presently to the connection between the two.

### **Macroeconomic Endogenous Growth Models: Where is the Prince of Denmark?**

None of what follows is to be interpreted as criticism, much less denigration, of the current or earlier macroeconomic growth writings. However, since it is my hope to carry study of the subject a step beyond what that work has been able to achieve, I must begin by indicating what this literature has not yet succeeded in doing. In particular, I believe that the macro analysis, like the microeconomic growth literature, has failed, indeed, it has not even tried, to grapple with the extraordinary growth record of the capitalist economies, as distinguished from economies of other sorts.

The earlier discussions took innovation to be an autonomous contribution of the passage of time—as a sort of manna dropped in a steady stream from some unspecified source, that could just as well emerge from a capitalistic economy or from any other. Later model builders recognized that this formulation was inadequate, and that there were features inherent in the economic processes that account for innovation and growth. Yet the endogenous features cited, notably the externalities of innovation, and the acquisition of human capital, in part through learning by doing, apply to many forms of economic organization and not only to the free-market economies.

In my view, like that of Schumpeter, this leaves these very valuable contributions as performances of Shakespeare's *Hamlet* that include the King, Ophelia, Gertrude, and many other of the crucial characters, but omit the Prince of Denmark. They tell us much about innovation and growth, but they fail to account for the most salient and extraordinary feature of the growth record, the entirely unparalleled success of the free-market economies. I will suggest that they fail to do so in part because they are macromodels, something patently unobjectionable in itself. But I will argue that it is a major handicap for study of the issue before us, which, I believe, is explainable primarily in terms of microeconomic behavior.

Recent growth analysis had its beginnings in the 1950s with the work of Solow and Swan, who deservedly elicited renewed interest in models of growth and in approaches compatible with statistical estimation. The models themselves represented no drastic break with the past, and clearly have their roots in the work of the classical economists, notably that of David Ricardo. The Ricardian model is sufficiently familiar and needs little review here. In short, it postulates that innovation results in a shifting of the production function and postponement of the stationary state, something that can occur repeatedly and can keep the

economy expanding indefinitely. What is missing in the Ricardian story is any explanation of the innovation mechanism, and certainly any endogenous innovation model. So the innovation process in the Ricardian model must be represented simply as a (stochastic) function of time and nothing else, and with no distinguishing features that differentiate the process in a capitalist economy from that in any other form of economic organization. Thus, Ricardo's story emphatically contains no role for the Prince of Denmark. The original Solow model, the prototype neoclassical model, contains a representation of innovation not much different from Ricardo's, with invention also autonomous, and undifferentiated as between free-market economies and other economic forms. The model assumes that there are diminishing returns to capital, an attribute that predicts convergence of productivities and per-capita incomes in different economies, because wealthier economies have relatively large capital stocks whose productivities, relative to those of poorer countries, are severely reduced by diminishing returns.

Romer recognized that this neoclassical model could profit from some modification. He observed that the facts do not support the model's prediction of universal convergence—the catch-up of all economies to approximately the same levels of productivity and per-capita income. The many statistical studies of the convergence hypothesis generally conclude that while the wealthiest economies have, indeed, been converging, most of the impecunious nations are falling further behind. Second, he reminded us that the innovation process is neither largely autonomous nor largely fortuitous. The amount of activity devoted to innovation, and the output of that activity, is influenced substantially by what is going on in the economy. This led to a series of constructs referred to as the endogenous growth models (see, e.g., Romer or Lucas or Grossman and Helpman).

However, what is significant for this discussion is that none of these formulations attempts to distinguish the free-market economy from other economic forms. Thus, whatever their virtues, none of them assigns a part in the scenario to the Prince of Denmark. Nor should this be surprising. Other economies, both historical and modern, have stressed education, have innovated, have experienced spillovers from education; and other sources. In short, they have exhibited all the endogenous innovation features of the newer models. But to get at the main special distinguishing features of the capitalist economy, I believe, it is necessary to turn to microeconomics.

### **Innovation and the Growth Process**

In discussing the growth performance of the capitalist economies, I will focus on innovation rather than other contributory sources such as human capital. A primary source of the growth miracle of the past two centuries, undoubtedly, is the surge of innovation that probably first reached a substantial pace in the first third of the nineteenth century. Improved education and the construction of factories, roads and other influences undoubtedly also made substantial contributions to growth, as the literature recognizes.

Yet, a very large proportion of the economic growth since the eighteenth century that is directly attributable to investment in human and physical capital probably is nevertheless ultimately attributable to innovation. For the incredible poverty of nations in earlier centuries meant that it was only the inventions of the industrial revolution that could provide society with the resources necessary to permit any substantial expansion of education or construction of plant and machinery. Only the growing outputs from innovation, first in agriculture and mining and then in manufacturing and transportation, made feasible the enormous increases in productive plant and equipment and in education (and other forms of investment in human capital) that are widely judged to have contributed greatly to economic growth. In other

words, without innovation the expansion of education and the economy's capital stock would have been negligible. Thus, it can be argued not only that innovation has facilitated the growth process, but that without it the process would have been reduced to insignificance.

### **What is Different About Free-Market Economies?**

It is in innovation, and not in invention alone, where we find answers to the great puzzle—the explanation of the free-market's unmatched growth performance. Earlier societies have had a spectacular invention record. The Chinese are the outstanding example. Centuries before Columbus they had invented printing, the compass, complex (water) clockwork, gunpowder, spinning machinery, a cotton gin, porcelain, matches, toothbrushes, playing cards and much more. There have been other countries in history with a considerable record of new products and new technology. Moreover, education was highly valued in the Chinese culture and others, though, it is true, much of the population was uneducated. Yet these inventions and this education never produced economic growth anything like that in the modern market economies.

It should be added that markets of substantial importance exist in virtually every economy of the world and have existed throughout recorded history. What, then, is different about modern markets that not only gives them the capacity to produce growth miracles but seems to get those miracles to happen very frequently? There can be no simple answer; indeed, any proposed answer is bound to leave out key features, ranging from political changes, evolution of religious beliefs and even historical accident. However, here it will be argued that two features of our economy have played a crucial role. The first such feature is free competition, that is, competition not handicapped by severe government regulations or tightly enforced customary rules, like those of the medieval guilds, that prevented gloves-off combat among rival firms. Of particular significance here is rivalry among oligopolistic firms. The second crucial development is the fact that in today's economy many rival oligopolistic firms use innovation as the main battle weapon with which they protect themselves from competitors and with which they seek to beat those competitors out. The result is precisely analogous to an arm's race – to the case of two countries, each of which fears that the other will attack it militarily and therefore feels it necessary always at least to match the other country's military spending. Similarly, either of two competing firms will feel it to be foolhardy to let its competitor outspend it on the development and acquisition of its battle weapons. Each is driven to conclude that at least matching effort and spending on the innovation process is a matter of life and death. Naturally, in an economy in which this is so, a constant stream of innovations can be expected to appear, because firms do not dare to relax their innovation activities.

### **Routine vs. Independent Endogenous Innovation**

A fuller description of my analysis focuses primarily on routinized innovation processes – those on which the amount of spending is determined routinely by business firms as part of their regular competitive strategic planning. The routine character of those processes is important because it permits their incorporation into standard models of investment and other parts of microeconomic analysis. Routine innovation processes—those guided by standard business-decision principles—are, indeed, of great and probably of growing importance, with 70 percent of U.S. research and development expenditure channeled through business firms.

However, this does not mean that the entrepreneurial independent innovator no longer plays a significant role. Nelson even concludes that “...Schumpeter's prognostication that as

science grew stronger technical innovation would become more predictable and routine has turned out to be a bad call.” [Nelson, 1996, p. 81].

And Scherer provides a long list of major technical inventions introduced by entrant firms and consequently not subject to the pressures for routinization in established enterprises. His examples include the incandescent lamp, alternating current, radio telegraph and telephony, the dial telephone, the synchronous orbit communications satellite, the turbojet engine, the sound motion picture, self-developing photography, the electronic calculator, among many others [Scherer, 1980, p. 438].

Indeed, one can offer the plausible conjecture that most of the revolutionary new ideas are, and are likely to continue to be, provided more heavily by independent innovators. In turn, these innovators, once successful, often establish firms of their own, joining the large enterprises that engage preponderantly in routine innovation. This type of innovation is primarily devoted to product improvement, increased reliability and enhanced user friendliness of products and the finding of new uses for those products. Both the independent and the routinized innovation activities undoubtedly contribute significantly to economic growth, as Rosenberg has emphasized [Rosenberg, 1976, p. 66]. These two types of activities appear to be complementary. Together they seem to contribute more to growth than either could by itself. There is also some reason to conclude that the incremental contribution of the routine activity adds more to growth than do the more revolutionary prototype innovations. Thus, consider how little computing power the first clumsy and enormously expensive computers provided, and how much more such power has been added by the many subsequent incremental improvements.

There is no reason to expect the independent inventor or the entrepreneurial innovator to become obsolete any time in the foreseeable future. Still, at least measured in terms of spending, the bulk of research and development activity seems to have become routine and this makes it far easier to analyze, and to spell out its role in the free-market economy.

### **Toward a Microeconomic Model of the Firm’s Spending on Innovation**

One conclusion that can be drawn from a competitive model of the innovation process, characterized by ease of entry into this activity, is that one can expect its profits to be driven toward competitive levels. And in fact, there is empirical evidence suggesting that in innovative arenas such as computer hardware and software, aggregating cases of success and failure, economic profits have been remarkably close to zero. But since innovation takes much effort and money, is very risky, and if the economic profits to be expected from innovation activity are held down by fierce competition of rival innovators, why do firms do it? The answer, at least in part, is that the competitive market mechanism gives them no choice. If they do not keep up with their competitors in terms of attractiveness of their products and efficiency improvements that permit them to keep their costs low, they will lose out to their rivals, and end up losing market share and losing money. Low economic profits, that is, profits that yield little more than normal competitive returns to investors, surely are better than negative profits.

The result is like an arms race between two countries, each of which fears invasion by the other. Each is driven to keep up with the other’s military expenditure. Raising its armaments expenditure will probably get it nowhere, because it can expect the other nation to match any such increase, raising expenditure without improving the nation’s military security. But at the same time, neither nation will dare to cut its arms spending unilaterally, since that will simply invite invasion by the other.<sup>3</sup>

Consider an industry with, say, five firms of roughly equal size, and suppose that the firm with whose decision we will be concerned, Company X, sees that each of the other firms spends about \$20 million a year on research and development. X will not dare to spend much less than \$20 million on research and development itself, because if it does so its next year's product will probably not be nearly as good as those of some or all of its rivals. On the other hand, it sees little point in raising the ante, say, to \$30 million, because it knows that if it does so the others will feel themselves forced to raise their research and development budgets correspondingly. So it will pay Company X to follow industry practice, investing \$20 million a year in research and development, and it may even go on doing so, year after year.

But that is not the end of the story. All five firms in the industry will continue to invest the same amount, until some year one of them has a research breakthrough and comes up with a wonderful new product (as happens in most high-tech industries from time to time). Then, for that firm it will pay to expand its investment in the breakthrough product, because that will pay off even if the other firms in the industry match the increase. Other companies in the industry will feel forced to follow, and now the industry norm will no longer be a \$20 million investment per year, but will instead be raised to \$25 million per firm.

The story, then, is that competition forces firms in the industry to keep up with one another in their research and development investment. But once they have caught up, the investment expenditure remains fairly level until, from time to time, something induces one firm to break ranks and increase its spending, with all the other firms following behind. Such a ratchet arrangement holds matters steady, permits investment in innovation under certain circumstances to move forward, but generally does not allow it to retreat. Research and development spending can then be expected to expand from time to time, but once the new level is reached, the ratchet—the competitive market forces—prevent a retreat to the previous lower level.

This, then, is a critical part of the mechanism that accounts for the extraordinary growth record of free-enterprise economies and differentiates them from all other known economic arrangements. It is the competitive pressure that forces firms to run as fast as they can in the innovation race just in order to keep up with the others.

### **Risk Reduction Through Technology Sharing**

A reason why it is sometimes suspected that free-markets will perform poorly in terms of growth is the alleged unwillingness of firms with proprietary technology to let others make use of it. The plausible story, which turns out not to be universally supported by the facts, is that the firms will always use secrecy, patents or any other means to retain the competitive advantage their technology gives them. As a result other firms are forced to use inefficient technology and to supply obsolete products, and the growth of the economy is thereby handicapped.

But it is not difficult to show, on the contrary, that if the license prices are sufficient, it will (and does) become attractive for firms to let others use their proprietary technical knowledge. Thus suppose the innovator firm can earn \$10 per widget that it produces itself, using its own technology to the exclusion of others. Then if a rival offers a license fee of \$12 per widget that this competitor produces it clearly will pay the proprietor of the innovation to accept the offer. And it will pay the rival to make such an offer if it is the more efficient producer of widgets (but the less efficient innovator). This is just as it pays firms to become suppliers of any other proprietary input, even to rivals, if the price is right. As a consequence, there exist profitable markets for licensed proprietary technology, of which Thomas Edison's laboratories were an early example.

Many firms also try to reduce their innovation risks by systematic technology trading. Each of two firms can be expected to fear that its labs may come up only with failures in some year, while its competitor may possibly have better luck in that period. The two enterprises will then have reason to seek an agreement for each to share with the other all of its successful future innovations, say, for the next five years.

This can also help the two technology-sharing firms to compete with a third firm, if their innovations are complements rather than substitutes. In portable computers, for example, one manufacturer may introduce an improved memory, another a more durable battery, and a third may invent a way to make the machine lighter and more compact. Each of these three firms has the choice of keeping its invention to itself. But if two of them get together and agree to produce computers combining the features each of them has contributed, they will be able to market a product that is clearly superior to what each could have produced alone. They are then likely to be in a far better position to meet the competition of the third manufacturer, which has no external sources.

Voluntary participation in the process of dissemination of technology is beneficial not only to the licensor, but generally also to the licensee, who obviously will not agree to pay a compensatory price unless it is profitable to her. As already noted, this will be so if the licensee is the more efficient user of the technology. But also relevant is the fact that such “friendly” technology transfer is both faster and cheaper than hostile transfer by means such as industrial espionage and reverse engineering. And in an industry in which technical progress is rapid, delay in access to a product can be tantamount to obtaining a product that is obsolete.

There are many firms and industries that engage in this sharing practice. They range from spectroscope manufacturers to steel producers. Firms exchange technology informally or enter into detailed contracts for the systematic exchange of technical information. The agreements often even require each firm to train technical experts from the other in the use of the new technology. The activity of business firms in providing their technology to others for profit, has become so commonplace that MIT has run a seminar for business firms, teaching how they can be more effective in the technology-provision business.

The process of technology dissemination for profit contributes to growth in free-market economies in at least two very significant ways. First, when innovations are disseminated widely, rapidly and voluntarily, they clearly hasten the retirement of obsolete technology. Second, the payments to the innovators can help substantially to internalize the externalities of innovation—the much-discussed spillovers that can constitute a major disincentive for the economically efficient amount of investment in innovation.

### **The Rule of Law and Productive Incentives for Entrepreneurs and Capitalists**

So far, I have focussed on the mechanism of free-markets that elicits a substantial growth contribution from business firms and their routinized innovation activity. I turn next to the independent inventors and innovators, and discuss the interactions between their activities and the workings of the free-market economies.

Despite the evident continuation on substantial scales of rent seeking and other forms of wasteful entrepreneurship under capitalism, never before has productive activity been so effective and prestigious as a method for the attainment of wealth, power and prestige. It seems evident that these three goals are the primary objectives of most entrepreneurs, and history indicates that many entrepreneurs are not particularly choosy about the means they utilize to achieve these ends. They, like those engaged in any other occupation, span the range of morality and dedication to virtue. So one can expect that there will be many entrepreneurs

who will choose whatever activities offer the greatest promise of attaining those objectives, whatever the social consequences of those most rewarding activities may be.

More than that—moral standards surely are not immutable. They tend to adapt themselves to current opportunities and practices, so that activities that today would be considered beyond the pale in terms of their ethics may in an earlier time have been accepted as normal and even commendable in a free-market economy.

In ancient Rome and medieval China, with their abundance of military and nonmilitary inventions, pursuit of wealth and power was considered acceptable, and even as desirable, as they are in the most greed-driven of capitalist societies. But the ideas about the means that were proper for attainment of these goals were very different from today's. Methods of wealth accumulation that were considered laudable in one or both of these societies included military aggression, ransom, bribery and usury. Some of the great figures of Roman history, for example, were respected for having acquired vast riches by these means. The Chinese mandarins, having been appointed to powerful positions, were expected to recoup in the form of bribes the heavy expenses they incurred in preparing for the difficult Imperial examinations that were requisites for such positions. No hint of scandal or disapproval attached to these means of accumulation.

But in both societies there were two types of activity that incurred unambiguous disgrace – participation in commerce or in productive activity (with the possible exception of some gentlemanly agricultural undertakings). In Rome, for example, such disgraceful endeavors were left to freedmen—to manumitted slaves and their sons. And these individuals, too, strove to accumulate sufficient means so that they could afford to leave their degrading occupations, or at least make it possible for later generations in their families to achieve respectability.

It is little wonder, then, that there was not much productive entrepreneurship in these societies. Even though, particularly, the Chinese produced an astonishing abundance of inventions, there was little innovation, in the sense of productive application and distribution of the inventions. Most such inventions were put to little productive use and often soon disappeared and were completely forgotten.

Destructive wars and rent-seeking activities as means to enhance wealth and power of course continued through the Renaissance and, indeed, they manifestly continue today. The idea that productive activity is disgraceful continued to guide continental European nobility well into the nineteenth century. But at least in Italy, the Low Countries and in England, things began to change, perhaps in the thirteenth to fifteenth centuries. As capitalistic activity rose in these countries, the relative ease of wealth attainment through banking, commerce and production may well have become irresistible. The attractiveness of such pursuits also grew as the constant and urgent need of funds by the royal houses expanded. As armies grew in size and arms and ammunition became more expensive, the kings found themselves repeatedly threatened with inability to finance their wars and with bankruptcy when they could not repay their vast loans. Phillip II of Spain—he of the Armada—underwent bankruptcy many times because the Cortes—the bodies of nobles whose assent for additional taxes was required—proved reluctant to levy additional tax payments on themselves.

The same was true of Parliament in England, where there was instituted, perhaps a century after Magna Carta, the principle of no taxation without representation (of the nobles and the gentry), an issue finally settled in the seventeenth century, in the battles between Parliament and the Stuarts. Edward IV, the Yorkist king, used many devices to get out of his financial difficulties. For us, it is most noteworthy that among the means he employed was entry into commerce. Equally important, a number of his nobles quickly followed his example.

Productive entrepreneurship in the free-market economies, then, has been encouraged materially by contraction of the opportunities for financial gain through rent seeking and destructive activities, and by the simultaneous explosion of ways of wealth-gathering in productive occupations. Productive entrepreneurship has also been stimulated by the growing power of the rule of law and the concomitant constraints upon arbitrary exercise of government power. A strong case can be made for the conclusion that without the rule of law, including the rights of property and the enforceability of contracts, the growth miracle of capitalism, indeed, capitalism itself, might not have been possible.

History also tells us about the advances in the economically crucial rule of law that occurred in the periods I have been discussing. In many earlier societies there was no such thing as the right of private property. At least in theory, all property belonged to the monarch, who was entitled to requisition any of it whenever it suited his purposes. This was notably true in ancient China, where not only money and physical property was subject to expropriation, but even innovations themselves were likely to be taken over by the state. For example, it is reported that "... frequently... during the course of Chinese history... the scholar officials... gathered in the fruits of other people's ingenuity... three examples of innovations that met that fate [are] paper, invented by a eunuch; printing, used by Buddhists as a medium for religious propaganda; and the bill of exchange, an expedient of private businessmen." [Balazs, p. 18]. Even religion did not prevent royal takings, sometimes on a massive scale, as in the expropriation of the Templars<sup>4</sup> by Phillip IV of France (Phillip the Fair) in 1307 or that of the monasteries by Henry VIII of England, more than two centuries later.

The resulting uncertainty was surely a major discouragement to saving and to innovative activity alike. Wealth was best rapidly consumed, lest it serve as a temptation to government acquisitiveness, and it may be conjectured that this contributed to the propensity of the nobility in a number of societies to be perpetually in debt. Productive innovation, aside from receiving little recognition, much less admiration, was rarely worth the required effort. Without the rule of law, clearly, enormous obstacles prevented economic growth of any substantial magnitude.

Capitalism itself, even more clearly, was precluded by absence of the rule of law. Capitalism requires markets in which the participants can have confidence in any agreements arrived at. It is driven by pursuit of accumulated and retainable wealth, and opportunities to expand that wealth by devoting it to the production process. Sanctity of property and contract, as well as institutions that can be relied upon to enforce them both, are necessary conditions for the creation of the capitalist and for effective execution of his role. That is why, without the contribution of the lawyers, the free-market economies might never have evolved. And even if they had, it is unlikely that their unprecedented growth could have occurred. It is on these grounds that I base my evaluation of the enormous total contribution of the lawyers to the performance of the industrial economies (while questioning their marginal contribution).

But how was the rule of law introduced? The key to the answer arguably lies in economic forces, together with the limited power of the Kings. At various times these rulers were forced to grant (and reconfirm) privileges and protections to their subjects either under direct compulsion (as at Runnymede in the case of Magna Carta) or in exchange for needed favors. For it must be understood that the term, absolute monarchy, was always a misrepresentation of the facts. Even the most powerful kings and emperors held absolute sway only over limited geographic areas and over subjects who were not too remote in location or in station. Primitive means of transportation, absence of standing armies rather than mercenaries or troops provided by powerful subjects under traditional arrangements, perpetual shortage of funds, and tiny administrative bodies, meant that the medieval and Renaissance kings possessed only very limited power. They had no effective tax collection agencies, a gap, as

we know, that prevailed in France until the Revolution. The kings also found it difficult to borrow, and had to pay higher interest rates than many other borrowers because there was no way they could make an enforceable commitment to repay. After all, there existed no court in which a debtor could sue the ruler.

The consequence, as we have seen, was that kings were frequently driven to beg for funds from the Parliament, the Cortes or the other bodies that held the power to tax, and those bodies frequently demanded and often received concessions in return. Under such pressures, and with their nobility often itself aggressive and unruly, the kings were forced, time after time, to agree to grant protections to various groups of subjects against certain arbitrary royal actions. The beneficiaries included not only the nobles but also the towns, which early began to acquire their traditional liberties. As these protections evolved and accumulated, they grew into a body of law. Driven by economic forces, the low medieval productivity and the resulting royal poverty, they became the legal foundation for a free-market economy in which entrepreneurship could flourish and production could explode.

### Concluding Comment

I have stressed several features of the capitalist economy that, together, arguably contribute most heavily to its unequaled growth record. The first is the routinization of innovation that transforms much of the enterprise from a sequence of chance occurrences into a businesslike activity that can be relied upon and is reasonably predictable. The second and, perhaps, most fundamental is the role of innovation as a primary competitive weapon, and the resulting innovation arms race. The third is the profit offered by voluntary dissemination of proprietary technology and its adoption as a normal business activity. Finally, I have stressed the incentive that capitalism provides to entrepreneurs to channel their activities into productive directions, rather than, as in many other forms of economic organization, in directions that contribute little to output growth or even impede it.

As I have said, perhaps the most important of these is the competitive innovation arms race in much of oligopolistic industry in the modern free-enterprise economies. Here, I take the liberty of mis-reporting somewhat Dr. Johnson's mot to the effect that "the prospect of hanging concentrates the mind wonderfully." The prospect of insolvency concentrates management's mind on the innovation race. No other economy has ever had anything near so powerful a driving mechanism, one that makes not only for a vast stream of invention, but for its rapid harnessing in productive uses.

The results of this paper may, perhaps, also be a step toward bringing the intertemporal welfare theory closer to reality. It can help to explain some of what is left out when the theory focuses on the spillovers of innovation, thereby leading to the expectation that the innovation performance of our economy may well be seriously inefficient. It may enable us to adapt the theory to the historically unprecedented growth and innovation performance of the free-market economies, the feature of those economies that has surely (and deservedly) been their most attractive attribute to nonspecialists.

### Footnotes

<sup>1</sup>[Keynes, 1932]. I must thank Senator D. P. Moynihan for calling this passage to my attention.

<sup>2</sup>It should be emphasized that there is a growing and very promising theoretical literature dealing with analytical tools that seem useful for the study of entrepreneurship. But they have not found their way into the core of mainstream micro analysis.

<sup>3</sup>The reader will recognize the direct analogy with the Sweezy kinked demand curve model of price stickiness in oligopoly pricing. There is also a touch of the prisoner's dilemma or, rather, the red queen paradox (see Khalil [1997]).

<sup>4</sup>The fact that the bulk of what Philip obtained from the Templars went to the Order of the Hospitalers rather than the royal treasury does not matter here. Philip seems quite clearly to have been seeking a new source of funds, having run out of such conventional sources as the Jews, who had just been expelled from France [Strayer, 1980].

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