

PRELIMINARY DRAFT: DO NOT QUOTE

ASSA 2006 Conference Paper: Innovation and Growth I: Theoretical Approaches

Sheraton Hotel – Back Bay C Room

10:15 AM-12:15 AM, Saturday, January 7, 2006

Further Steps to a Theory of Innovation and Growth – On the Path Begun by Knight, Hayek and Polanyi

Edmund S. Phelps*

The U.S., it is agreed, has a relatively capitalist economic system. Not many other countries do, even though private ownership is now predominant nearly everywhere. China's system is called "state capitalism" in view of its state-run financial sector. The system in continental western Europe is so constrained by corporatist blocs and subjected to corporatist interventions that it is called the "social market economy," not capitalism. But what exactly is capitalism?

Capitalist systems are private-ownership systems characterized by, first, their openness to new commercial ideas – the ideas of entrepreneurs for new products and new methods – and, second, their decentralized mechanisms for selecting the ideas to finance and providing the needed capital and incentives. To most proponents, Schumpeter for example, and to most critics, Marx for example, capitalism's strength is its *dynamism* – the readiness and adeptness with which it moves forward. No doubt this dynamism derives in part from the creativity of entrepreneurs and the acuity of financiers in judging which entrepreneurial ideas to back.¹ Yet our understanding of the mechanisms and economic institutions involved, and why capitalism's dynamism is apparently hard to match, has not advanced far since the seminal insights of the early modern theorists of capitalism – notably Knight, Hayek and M. Polanyi.

I want to begin by reviewing the legacy of those thinkers. Next I sketch some ideas of mine for further development of their seminal insights. It will be clear I have made only a start but I hope the start is worth airing.

The Emergence of Capitalism Theory

It might be thought that the theory of capitalism's dynamism originates in the classical case for a competitive market economy, begun by Adam Smith two centuries ago. His thesis was that the presence of many buyers and many sellers competing with one another in the marketplace causes wasteful

* McVickar Professor of Political Economy and Director, Center on Capitalism and Society, Earth Institute, Columbia University. Max Amarante and H. T. Hoon have collaborated with me on portions of this research.

¹ Capitalism also has a reputation for instability, thus job insecurity, and for incomplete inclusion of the disadvantaged. It is true that capitalism has seen long swings in recent decades. However, the relatively capitalist economies have been bigger job creators than continental Europe's corporatist economies.

resource allocations to be weeded out “as if by an invisible hand.”² Under equilibrium conditions, at any rate, efficiency would prevail. (One person’s earnings could be increased only at the expense of another’s.) This valuable ability of unimpeded markets could not be matched by a central government bureau. That was common ground in critiques of communism by “market socialism” theoreticians and capitalism theorists in the Interwar years.³

One of the early moderns, Ludwig von Mises, warned in the 1920s that the competition of firms under private ownership could not be matched by the competition contrived by market socialism either. If managers will not receive the profit and bear the risks of their decisions, the resource allocations of socialist competition will be highly inefficient – a thesis making Mises the founder of property-rights theory.⁴

However, Mises’s theoretical argument that competition *with* private ownership delivered greater economic efficiency than state-run competition would did not imply that such competition also delivered greater economic dynamism – or indeed any dynamism. It was left open whether competition among firms suffices to generate *dynamism* with and without private owners. And whether private ownership suffices for *dynamism* without competition.

It might alternatively be thought that the theory of capitalism’s dynamism originates in the pioneering work on economic advances by the German School, led by Arthur Spiethoff and Gustav Cassel, in the first decade of the 20th century. Beginning with them, modeling economic advances was a leading object of economic research for decades. But their work was not fundamentally about capitalism. Their work linked innovations to forces taken to be exogenous to the market economy, such as technological breakthroughs and the opening up of overseas markets and materials.⁵ A new discovery created new outlets for investment. The investments made “express the zeal of employers to profit by meeting the increased demand of the community for fixed capital.”⁶ This provided a useful view of some historically important innovations – innovations driven by a technological

² This section reworks and expands upon material posted on the website of the Center on Capitalism and Society in 2001. Roman Frydman and Andrzej Rapaczynski also contributed to that material.

³ Oskar Lange famously attributed the proposition to Mises. So did Hayek. But Mises, seeing his book as primarily an original criticism of market socialism, did not welcome the credit.

⁴ Ludwig von Mises, *Die Gemeinwirtschaft*, Jena, 1922. English trans. by J. Kahane from the 2nd edn., *Socialism: An Economic and Sociological Analysis*, London, Jonathan Cape, 1936. As it happens, our own Joseph Stiglitz laid the failure of the market-socialist experiment (and of communism) to the inefficiencies resulting from its failure to institute suitable incentive mechanisms. See his *Whither Socialism?* Cambridge, Mass., MIT Press, 1994.

⁵ Arthur Spiethoff, *Jahrbuch für Gesetzgebung, Verwaltung und Volkswirtschaft*, 1903. Alvin Hansen marvelously surveys this era of economic thought in Ch. 16 of his *Business Cycles and National Income*, New York, W. W. Norton, 1951. He explains that in introducing knowledge shocks Spiethoff was not repeating – he was departing from -- Michel Tugan-Baranowski’s earlier work on shocks to investment.

⁶ Gustav Cassel, *Theory of the Social Economy*, trans. from 1918 edn., New York, Harcourt, Brace and World, 1924, p. 622.

shock outside the market economy.⁷ This is all well and good as far as it goes.

However, it is not clear that capitalist institutions may share the credit with the great discoverers for the resulting innovations. Although the analysis was couched in terms of a competitive economy with private ownership and unfettered entrepreneurs, it did not imply that only economic systems of the capitalist kind dependably seize the investment opportunities presented. Indeed, Spiethoff and Cassel may not have believed that the choice of economic institutions –among capitalist ones or among a broader set including socialist or corporatist ones – importantly shaped the response of economies to new exogenous opportunities. After all, they were writing on the eve of Europe’s socialist and corporatist movements, which promised superior or faster economic progress. (Certainly the German School did not identify or speculate about the institutions needed to enable or foster prompt and suitable responsiveness to a newly arrived opportunity.) Furthermore, their model did not provide an economics of innovations in normal times, when new ideas are not being sparked by the latest technological development but simply draw upon the vast stock of technologies inherited from the past.

Comparative evidence on dynamism. Empirically, the kind of economic system in place does appear to make a difference for dynamism. A few central European economies twice became laboratories in recent decades for testing competition *without* private ownership. From the late 1960s to the late 1980s they allowed each state-owned firm to set their own prices, outputs, wages and workforce in competition with the others. Whether or not efficiency improved, it was clear that economic dynamism did not ensue. It was said in defense of these state firms that their managers’ plans for them were often blocked by the state and that the managers knew they could get their losses covered by the state so they didn’t need to take chances. In the 1990s, the state firms were put on their own. This time, with their backs to the wall, they began innovating like mad, hoping that with luck it would be their ticket to survival. But these state firms were not able to innovate profitably.⁸ Competition, it appears, is *not sufficient* for economic dynamism.

Recent evidence on corporatist systems, where ownership is private but capital is not very free (entrepreneurs are fettered, financing is distorted, the state is freely interventionist, and more) is also quite negative. The corporatist economies of continental western Europe, which by copying new methods and products overseas posted outside productivity growth from the mid-1950s even to the early 1990s, largely catching up to U.S. productivity in the process, remained impassive when visions of the internet revolution caused entrepreneurs and financiers in the U.S., U.K., Canada and Ireland to bolt out

7 Phelps and Gylfi Zoega build on Cassel in ‘Structural booms,’ *Economic Policy*, 32, April 2001.

8 Roman Frydman, Marek Hessel and Andrzej Rapaczynski, “Why Ownership Matters: Entrepreneurship and the Restructuring of Enterprises in Central Europe,” mimeo., February 2000.

of the starting gate in the last half of the 1990s.⁹ The corporatist economies of east Asia, which had achieved wonders as long as there was a wide gap between them and the West, ran into trouble in the 1997 because state intervention in the corporate sector through permissions, subsidies and guarantees led to mass overinvestment and insolvency.¹⁰ On this thesis, private ownership is *not sufficient* for dynamism either: Capitalism, in which capital is free to go in new directions without a green light from the state, the community and power blocs, becomes necessary at some point in a country's economic development if dynamism is to emerge.

The emergence of the modern understanding of capitalism's dynamism

Joseph Schumpeter in his groundbreaking book, first published in 1911, provided the first model of economic change through innovations *internal* to the marketplace of capitalist economies. Innovations, he said, rarely spring quickly and reliably from recent inventions by scientists and engineers, which are infrequent in any case. Rather, innovations are normally the creation of business people informed by their observation and own experience. This was convincing particularly in Schumpeter's terms, since for him an innovation was not only a new methods but also a new products, material, markets or business organization. He added that innovations "are as a rule embodied...in new firms."¹¹ Thus the agent of change was the *entrepreneur* who, hitting upon the prospective profitability of some unnoticed commercial application, undertook a new venture aimed at implementing the innovative idea.¹² Banks – the venture capitalists of Schumpeter's era – selected the investment projects to finance. The start-ups that met success stimulated other entrepreneurs to imitate and together they cause the "creative destruction" of some existing products, methods and jobs.

This somewhat Darwinian model was widely taught and Schumpeter became renowned for it. Yet many economists still think of entrepreneurship as the Germans did: as unfailing market reactions to recent inventions – contrary to Schumpeter's revolutionary idea. It would be more attuned to Schumpeter's view to say that inventors are handmaidens of entrepreneurs.

Schumpeter's model has the unsatisfactory limitation that the market outcome of the innovations made by each entrepreneur funded by the banking system is statistically known – the entrepreneur and the banker know the odds of the possible outcomes. Some interpreters went so far as to liken

⁹ See Edmund Phelps, 'Europe's stony soil for the seeds of growth,' *Financial Times*, 9 August 2000. See also sections 1 and 5 of Phelps and Gylfi Zoega, 'Structural booms,' *Economic Policy*, 32, April 2001.

¹⁰ This is the hypothesis in Phelps, "Lessons from the Corporatist Crisis in Some Asian Nations," *Journal of Policy Modeling*, March 1999.

¹¹ Joseph A. Schumpeter, *Theorie der wirtschaftlichen Entwicklung* (Vienna, 1911; Leipzig, 1912), trans. Redvers Opie, *Theory of Economic Development*, Harvard University Press, Cambridge, Mass., 1934, quoted p. 66, and "Die Wellenbewegung des Wirtschaftslebens," *Archiv für Sozialwissenschaft*, 1914, 1-32.

¹² The French term *entrepreneur*, meaning undertaker of a project, was first used in economics by Richard Cantillon and made famous by Jean Baptiste Say. John Stuart Mill imported it into English. Schumpeter, writing in German, used the corresponding word *Unternehmer*.

entrepreneurs to people who stumble on five dollar bills on the street – a sort of arbitrage and a “sure thing.” The ideas of the entrepreneurs that get funded are all “bankable propositions.” In this respect, Schumpeter’s mechanism is not consonant with subsequent understanding of the *essential nature* of innovative ideas. It also has the limitation of locating innovation in start-up entrepreneurs, which is, on its face, incongruent with actual capitalism.

The essential nature of entrepreneur’s innovations was the grand project of Frank Knight and Friedrich Hayek. As is well-known, it was Knight who in his 1921 book developed the distinction between *risk*, which is *insurable* by purchasing an insurance contract from a diversified insurer, and *uncertainty*, or *Knighitian uncertainty*, which insurers will not touch, since, absent an intensive investigation such as a financier might make, they have no way of typing and calibrating it.¹³ Knight’s thesis was that an entrepreneur’s new business project is in some respects unique and the relative frequencies of past events are not sufficient to estimate the probabilities of the future returns of the project. (Indeed, Knight insists that *every* business situation is unique, thus that there is nowhere in capitalist business any such thing as prospects that are statistically *known*.) The entrepreneur’s strategic decisions are subject to uncertainty, therefore. Knight thinks of the entrepreneur as the owner of the business, and therefore as the bearer of this uncertainty. But today’s “structured,” or “layered,” contracts place most of the ownership in financial intermediaries, such as banks and pension funds, which bear the financial risk, much as Schumpeter supposed. However, the entrepreneur, in braving uncertainty, does face the penalty of being replaced if his judgments are felt to be sufficiently disappointing to the owners holding decisive stakes.

Hayek, emphasizing the untried nature of what the entrepreneur with a new project is attempting, introduced in the mid-1930s a distinction between two kinds of knowledge.¹⁴ In the classical view, knowledge is entirely unambiguous and complete, so its implications are fully determinable. There is nothing we know we don’t know and nothing we may come to know that we do not already know. In the Hayekian view, actors in the world have to make judgments that are not fully implied by their formal models: As Keynes wrote, “It is necessary finally to act.” And that requires them to draw upon their *tacit*, or *personal*, knowledge: “We know more than we can say,” as Michael Polanyi put it. In the growth-of-knowledge school of Hayek and Polanyi, formal knowledge advances in the sciences as scientists combine their tacit knowledge with their existing formal knowledge in conceiving and selecting hypotheses to test and experiments to make.¹⁵

¹³ Frank H. Knight, *Risk, Uncertainty and Profit*, New York, Houghton Mifflin, 1921. See 35-38.

¹⁴ Hayek, *Collectivist Economic Planning*, London: George Routledge, 1935, and Hayek, *Individualism and Economic Order*, London, Routledge, 1937.

¹⁵ Classic references are Friedrich A. Hayek, “The Use of Knowledge in Society,” *American Economic Review*, 35, 519-530, 1945; Hayek, “Competition as a Discovery Procedure(1968),” *New Studies in Philosophy, Economics and the History of Ideas*, Chicago, University of Chicago Press, 1978; and Michael Polanyi, *Personal Knowledge*, Chicago, University of Chicago Press, 1962.

Hayek then applied this view of the “growth in knowledge” to the activities of innovation and discovery in capitalist economies. The entrepreneurs come to their distinctive judgments through their distinctive personal experience and resulting personal knowledge, or “know-how” in his terminology. Similarly, the technical work in engineering and marketing a new products or methods involves personal knowledge. “[M]uch of the knowledge that is actually utilized is by no means ‘in existence’ in [a] ready-made form. Most of it consists in a technique of *thought* which enables the individual to find new solutions.”¹⁶ Thus capitalist economies generally draw on a diversity of tacit knowledge that in the aggregate is vastly more than any one banker or shareowner or central planner could possibly possess or even conceive of. (Hayek held that since innovations entail creative leaps and invariably these leaps involve tacit knowledge, which is outside recognized knowledge and hence goes beyond what can be communicated in explicit terms, a state investment bank would not be well-suited to select among entrepreneurs’ projects: Being accountable to the central government for its mistakes, it would avoid all the very innovative proposals because of the ambiguity of the evidence for them and the consequent impossibility of communicating their appeal to higher authorities or to the public.)

It follows that the many lenders and investors selecting among entrepreneurs’ projects in a capitalist economy are likewise not immediately able to grasp the worth of every project of the entrepreneur proposing to undertake it. Thus financiers must also act on intuition, deciding to take or not to take an initial and limited chance on an applicant in spite of the ambiguity of the evidence. If the typical innovative project is in part inherently inarticulable, the success of bankers and venture capitalists in selecting among them hinges not only on their acquired understanding of the entrepreneur’s project but also on their ability to enter into a sequential and provisional relationship with the entrepreneur that leaves the latter leeway to experiment and prove himself.¹⁷ All this is a far cry from Schumpeter’s “bankable proposition.”

It further follows that the success of an innovation remains a matter of considerable uncertainty until it is determined by the reception it finds among potential users in the marketplace. As Hayek must have enjoyed commenting, the strength of the demand for the novels of C. P. Snow could not be known beforehand, not even by the author himself, until they were produced and offered to the bookbuying public.¹⁸ Every innovation is like a scientific experiment in which, characteristically, the probabilities of the various results are not determinable beforehand -- nor fully determinable afterwards either.

¹⁶ Hayek, “Socialist Calculation II: the State of the Debate,” in *Collectivist Economic Planning*, London: George Routledge, 1935, reprint., *Individualism and Economic Order*, London, Routledge, 1937, p. 155.

¹⁷ Richard Nelson and Thomas Marschak saw the importance of sequential arrangements in a 1960 paper.

¹⁸ Hayek, “The *Non Sequitur* of the ‘Dependence Effect’,” *Southern Economic Journal*, April 1961, reprint. Phelps, ed., *Private Wants and Public Needs*, New York, Norton, 1962.

The potential users themselves may have little idea how much they will like the new product or method unless and until they try it. (Users cannot plausibly be assumed to know that *a priori* if, as Hayek supposed, the entrepreneur, who is an expert and himself a consumer, does not know he has anticipated all the things that might deny him success.) Thus households and firms deciding on a new product or method have the same knowledge problem as do the entrepreneur and financier behind the product or method. Economies of dynamism are shot through with Hayekian knowledge formation.

The insights of Knight and Hayek address another gap, mentioned in passing earlier, left by Schumpeter's 1911 mechanism: While resonating with the innovation of the lone entrepreneur and his or her start-up firm, it appears to have no recognizable connection with innovations originating in the management of the large corporation. The thesis of Amar Bhidé is that small firms have a role in innovation because they have an absolute advantage in coping with Knightian uncertainty and large firms have a role in innovation because they have an advantage in managing and financing projects with high capital costs.¹⁹ The interplay between the small-firm sector and the large-firm sector will perhaps unlock the Misesian puzzle: Large firms are bureaucratic and, especially in the U.S., typically owned by passive shareowners so they do not usually have a principal lender or core investor who can choose in-house "entrepreneurs" to back and advise on their innovative projects. Yet the large firms account for the lion's share of the industrial research and seemingly of innovation as well. The resolution may be that the new and successful ideas of the start-up entrepreneurs owe most of their further development and possible extensions to high-capital-cost projects at the large firms – including the large firms that the start-up firms sometimes grow to be and the large firms that buy up successful start-up firms. If the raw material for innovation by large firms is the underdeveloped innovations of recent start-ups, models of large-firm innovation based instead on the "defensive innovation" of the 1942 Schumpeter, cannot function without the stimulus of the start-ups.

Knight's recognition of the uncertainty surrounding business decisions, and Hayek's bottom-up theory of the growth of knowledge, in contrast to top-down notions, has ramified over a wide range of subjects and influenced numerous economists and political scientists, including Jane Jacobs, Milton Friedman, Michael Oakeshot and James C. Scott.²⁰

¹⁹ Amar Bhidé, *The Origin and Evolution of New Business*, Oxford, Oxford University Press, 1999.

²⁰ Jane Jacobs, *The Death and Life of Great American Cities* (NY, Vintage Books, 1961); Milton Friedman, *Capitalism and Freedom*, Chicago: University of Chicago Press, 1962; Michael Oakeshot, *Rationalism in Politics*, New York, Basic Books, 1962; and James C. Scott, *Seeing Like a State*, New Haven, Yale University Press, 1998. (Referring to medical practice, Friedman wrote "...[A] faith healer may be just a quack who is imposing himself on credulous patients, but maybe one in a thousand or in many thousands will produce an important improvement in medicine. The effect of restricting the practice of what is called medicine...is certain to reduce the amount of experimentation that goes on and hence to reduce the rate of growth of knowledge in the area." p. 157.)

A Framework for Modeling Innovation: Suggestions and Applications

I am going to sketch of a model of a capitalist economy, thus an economy having entrepreneurial ideas at its center. The first objective is to construct in broad outline a micro-founded model of the mechanism governing what we might call the “flow-supply” of new ideas to the *innovation market* coming from entrepreneurs and the “flow-demand” from financiers. The subsequent objective is to consider informally how the circumstances and expectations of entrepreneurs and those of financiers – in short, *market forces* – affect the outcome of their interaction. It will be good to have market models of the supply and selection of entrepreneurial ideas, since they are so central to business life. And we cannot feel confident we understand much about differences in economic performance among nations until we can separate what in the economy’s experience is truly attributable to institutions from what is the merely result of favorable or unfavorable market forces. That means studying both the entrepreneur as a micro actor and the entrepreneurial economy as an interactive system. In this first pass, though, it is best to abstract from the rich set of institutions present in real capitalist economies.

The construct of an “innovation fair”

The classic supply-and-demand apparatus does not apply to the *core market* of capitalist economies – the capital market, particularly the market for capital going to entrepreneurs’ innovative projects. The least of the complications is that every entrepreneurial project is a different good, just as every new house placed on the market differs from the others. That each entrepreneur’s idea is idiosyncratic, hence unique, does not by itself preclude a manageable model of equilibrium.

In the interest of simplicity, I will introduce a construction that reflects the fact that an economy is spread out over space, so the economy’s actors are not ordinarily in contact with a large sampling of others, but they can convene with others intermittently for purposes of important transactions. I will suppose that periodically – once every 5 years, for example – all the entrepreneurs who in the previous period have hit upon a new idea they regard as worth the trip travel to a sort of fair to seek financing. A comparable number of financiers, each with a large pool of liquid capital, attend the fair to seek entrepreneurial projects to invest in or make loans to. They are the abstract counterparts of today’s hedge funds and venture capital funds.²¹ (I was delighted to learn about a year ago that such fairs actually take place! The entrepreneurs reportedly remain stationary while a procession of the financiers circles around them.) Once they contract to finance a project they will act as partners of the entrepreneur, drawing on their generally different experience to solve problems in the development and launch of the new product or method.

²¹ A hedge fund marks to mark its assets, so its investors have an idea of the price they could expect for their shares if they decide to leave the fund. Investors in a venture capital fund are more nearly locked in.

With the project's completion the financiers will sell their shares in an IPO on the stock exchange and their bonds on debt markets.

It might be thought that the capital-market model devised by Irving Fisher and James Tobin, originally applied to many heterogeneous investment projects, could be a satisfactory tool to analyze the innovations market.²² Whether applied to investment projects or to innovation projects, that model implicitly supposed that there is *no ambiguity* about the promise of each such project. As a result there is agreement among the financiers about the value of each project: it is the present value of the agreed expectations of the stream of future gross earnings it would generate. The investment cost of each project is also a given. It then followed, as Tobin showed, that the capital market would rank highest for financing the project(s) with the highest calculated value per dollar of investment cost; would rank second-highest the project(s) with the next highest ratio of value to cost; and so forth until there were no more projects with a positive rent – with a value-to-cost ratio (Tobin's *Q* ratio) greater than one. An inframarginal entrepreneur collects from his financier(s) a rent that, added to the above investment cost, leaves her (the financier) with the same zero expected profit on that investment as would be expected on the marginal project.

I would comment that such a Fisher-Tobin equilibrium *may* exist even if the profitability of each project is subject to exogenous sources of *uncertainty* (i.e., Knightian uncertainty in which no one knows the probabilities of all the various conceived outcomes or even knows all of the possible outcomes there are). An unambiguous ranking of projects would still exist if some war of unknown probability would be expected by all, should it occur, to reduce the value of all projects in equal proportion; in that case the ranking would not even be affected (though fewer projects might make the cut). More generally, a ranking would still exist if it is understood that exogenous shocks of unknown probability would impact *unequally* on the values of the various projects, *provided* the financiers are alike in their judgment of those impacts and the weight they give to the shock and their judgment of those impacts and the weight they give to the shock.

But complications set in once we recognize, following Hayek and Polányi, that the entrepreneur's idea presents some *ambiguity*: The entrepreneurs are to some extent like the fighter pilots: unable to explain the thinking behind their decisions.²³ So, in any brief initial interview, the financiers can see only dimly what each idea is, what would be involved to implement it, and what the selling points and the snags might be if it were marketed. Moreover, Since financiers weighing projects have to use their

²² I. Fisher, [to be supplied], and J. Tobin [to be supplied].

²³ The post-Polányi literature includes Hubert Dreyfus, *What Computers Still Can't Do* (Cambridge, Mass., MIT Press, rev., 1979) and Gary Klein, *Sources of Power: How People Make Decisions* (Cambridge, Mass., MIT Press, 1998).

own limited experience and specialized knowledge, and these differ from financier to financier, the financiers *do not all make the same valuations*. Hence, even if each financier falls into a group of like-minded financiers each of whom views the entrepreneurs' proposals the same way, one such group might *rank* the projects *differently* from another. So if we are to build a usable model of the intersection of the entrepreneurs' projects and the financiers' capital it is necessary to see whether disagreements in financiers' rankings are apt to be a barrier to the conclusions we might hope to reach.

To narrow down possibilities I propose to give the model more structure by supposing that each financier prefers to back the idea of an entrepreneur whose "model" is most resonant with his own – his thinking with regard to which industry is the best bet, swinging for the fences or not, and so forth.²⁴ So the "capital market" is a sort of matching process that mates a financier to an entrepreneur who the former sees as having a model compatible with his own model. In this way the financiers are matched to the projects where their outlook and assistance can contribute the most. Thus capitalism is portrayed as producing a profusion of ideas representable as competing models of the economy (or a piece of it); and entrepreneurs and financiers with the same model band together in a bet on its ability to prove itself.

After the entrepreneurs have had their initial interviews, some of them will generally enter into a further discussion and that may lead to letter of intent from a financier (and possible partners). The penalty for withdrawing from such a commitment makes it quite unlikely that the financier will fail to reach or negotiate a contract and instead proceed to send a new letter of intent to another entrepreneur. Entrepreneurs who do not receive or do not accept such letters leave the game, their project having failed to gain finance.

Equilibrium and disequilibrium in the innovation market

To discuss forces acting on equilibrium and departures from equilibrium we need to define it. As I customarily do, I will use the expectational definition of market equilibrium, which was originated by Marshall and Myrdal. I use a macrosque version of this equilibrium, referring to representative agents. And I put intertemporal considerations aside, leaving intertemporal equilibrium as a separate concept. This equilibrium in the innovations market requires that the entrepreneurs as a whole are not overestimating the average value per investment dollar being placed on the projects of the *other* entrepreneurs, so the entrepreneurs are not being misled by such an expectational errors into holding out for higher terms than they would otherwise do; similarly, the entrepreneurs as a whole are not underestimating the average value per investment dollar. This equilibrium also requires that the

²⁴ The Bradley brothers, two celebrated entrepreneurs in Minneapolis some decades ago, remarked on precisely this core aspect of entrepreneurship (without benefit of reading Hayek, so far as I know). "The entrepreneur," they wrote, "invents a new model of the world from which he derive his new business project." (Quoted by memory from documents ca. 1998.)

financiers as a whole are not overestimating the average value per investment dollar that the *other* financiers are offering, so the financiers are not being misled by such an expectational error into offering higher terms on the projects they want than they would otherwise do; similarly, the financiers are not generally underestimating the average value per investment dollar.²⁵ Obviously the case of equilibrium case does not rule out that *some* entrepreneurs have been misled by his or her expectations about the outcomes on the market; it only specifies that the errors have canceled out.

This expectational equilibrium does not imply market clearing. Indeed it is reasonable to suppose that, even if their *market* expectations (just discussed) were correct, *some* of those entrepreneurs were overly bullish about the appeal of their *own* project *and* some subset of these entrepreneurs finally found themselves having no more offers to agree to. Although they may have made successive inferences leading to successive reductions of their “acceptance price,” not all of them necessarily reduced their acceptance terms fast enough to avert the result that their projects are not under contract by the time all the financiers have committed all or nearly all their funds on other projects. (There is no “recontracting” here. The discussion after the initial interview that may lead to letters of intent may have high opportunity costs, so that penalties are provided for withdrawing from a commitment.)

Another observation is that even if the innovation market enjoys an equilibrium, it does not follow that this equilibrium is completely independent of which transactions happen to be made early as one project after another is adopted by financiers. Owing to the Hayek’s point that much of the entrepreneur’s understanding of his proposed innovation is personal knowledge, a financier will have far from complete knowledge about it and will have little idea of what any other person’s knowledge about it is. Thus there may be learning in this regard over the course of the market’s allocations of projects and the information on the terms at which they are sold. Further there may be some chance factors influencing whether or not some subset of projects are bought up early. So the future of the bidding may depend to some extent on which projects happen by chance to be sold early in the process. So the equilibrium in the market for these Hayekian objects may not be uniquely determined. However, the possibility that there is some indeterminacy around the equilibrium and maybe not pure white noise should not deter us from investigating the effects of forces acting on equilibrium and the effects of disequilibrium as long as the answers to the questions asked are not sensitive to the particulars of the equilibrium that is or would have been reached.

What drives financiers to back any innovation at all?

It is perfectly natural to wonder whether an equilibrium in this innovation market is necessarily one in which a positive number of projects win

²⁵ The above requirements for equilibrium in the innovation market capture the spirit of the concept, even if it should be found that some further requirements are appropriate to add.

financing. Maybe it is only because entrepreneurs can finance themselves or they are friends or relatives of a financier that they can get their projects going. On this issue, I would argue that even in the case of *perfect ignorance* on the part of the financiers – so that financiers were unable to distinguish one entrepreneur’s project from another (and one entrepreneur’s character and talent from another’s) – financiers would generally supply some financing and some innovation will go ahead. My argument is this: If all the new projects offered looked the same to financiers, applications of pseudo-entrepreneurs would explode if Tobin’s Q ratio exceeded one or even equaled one, since a great many people would prefer being an entrepreneur to being a salaried employee – especially an entrepreneur paid an entrepreneur’s wage. So the expected Q ratio in every period would have to lie in a range below one. And if the entrepreneurs valued projects only for the positive rent they received from it – the rent consisting of the excess financiers pay over the investment cost (figured at market wage rates) – then none of the innovative projects would be undertaken. But if there are some entrepreneurs who estimate highly enough the non-pecuniary satisfactions that would accrue from doing their project (the thrill of it, the learning experience) and if these entrepreneurs would accordingly subsidize the project with a reduced salary in order to fill the gap between the investment cost (figured at normal salaries) and the deficient valuation put on their project by financiers, then they will be able start their projects. If the promise of entrepreneurs to work at subsidized wage rates out of professed love of their work looks to be incentive-incompatible (maybe the entrepreneur will restore his wage, causing the financier’s returns to suffer), the entrepreneur may be able to signal his love of the project by investing resources of his own or family members in spite of the less-than normal rate of return that is expected. (For what it is worth, James Tobin told me at Yale that Schumpeter believed that entrepreneurial projects earned a below-normal rate of return. I have not found that in print though.)

A more general point here is that in all cases – the case of financiers’ perfect ignorance and the case of financiers’ imperfect (initial) knowledge – *some* portion of the entrepreneurial activity taking place is the result of the large concessions (in returns or leisure sacrificed) that some of them make on their own *labor* or on their own *capital investment* in order to have the nonpecuniary satisfactions of their project.²⁶ If that is so, the *supply* of entrepreneurial projects is a more important concept than it is usually understood to be. More precisely, the *acceptance price* that the entrepreneur requires on his existing project will be lower the higher his expectations of the project’s nonpecuniary reward to him. And the *reservation price* at which he will supply the attention and concentration necessary for conceiving of the entrepreneurial idea will likewise be lower the higher are those expectations. This is in contrast to the “textbook” model: In the Fisher-Tobin model of investment, which can be applied in principle to investing in new products and

²⁶ Their overly enthusiastic forecasts of the rate of return on investments in the project will also tip them toward accepting worse terms from financiers to get the project over the top.

methods, an entrepreneur is activated, or deployed, by the financial sector if and only if *its* expectations of the value of the entrepreneur's project exceeds the opportunity cost of the project; the entrepreneur's expectations do not figure in.

Influences of expectations, wealth and economic culture

The perspective of the market model I have been using here suggests to me three points in all. *First, entrepreneurs' expectations* of the nonpecuniary rewards from entrepreneurial labor and of the pecuniary rewards from their own capital investment in the project must matter for the volume of entrepreneurial activity, not just financiers' expectations. This leads in turn to the macro-economic proposition that the expectations of *both* actors matter for the determination of total business activity, as measured by total employment. Also, an optimal contract between entrepreneur and financier will reflect any difference of optimism between entrepreneur and financier. (Previous work on contracts has posited, explicitly or implicitly, that the parties to a contract share the identical "rational expectations," since they have the identical model of the world. Work in that vein does not fit in a theory of capitalist economies, in which views are never homogeneous and may be wildly diverse.)

Second, if the size of the concessions that some or all entrepreneurs would be willing to make (if the project turned out to be the marginal one) are a "normal good," so that a *given entrepreneur* would have a *lower* reservation reward the *wealthier* he is, then increased wealth operates to contract the "supply" of projects – more precisely, to shift down the acceptance price and the reservation price of entrepreneurs.

On the other hand, an increase in the wealth of financiers or of the depositors who invest in the venture-capital and hedge funds run by the financiers may boost the *demand* for entrepreneurial projects, i.e., boost the supply of finance. My long-time collaborator Hian Teck Hoon points out that if the economy is coming off an innovation-based boom in which a generation of entrepreneurs have made a great deal of money, that may boost the supply of finance to the next generation of entrepreneurs. The modeling and statistical investigation by Aghion and Howitt (often with Acemoglu or others) proposes a somewhat similar yet distinct hypothesis: the credit worthiness, or credit line, that an entrepreneur has may be roughly proportional to the entrepreneur's wealth. It may prove difficult to determine which wealth effect is driving some of the statistical findings in the recent paper by Aghion et al.²⁷ (But see discussion below involving incentive-type contracts.) In any case we have a conflict between wealth's effect on the supply of projects (the previous paragraph) and its effects on the demand (this paragraph).

²⁷ Philippe Aghion, Peter Howitt and David Mayer-Foulkes, "The Effect of Financial Development on Convergence [of the Productivity Growth Rate]: Theory and Evidence," *Quarterly Journal of Economics*, 120, February 2005, 173-223.

Third, there is the implication that a country's *economic culture* may play a part in the determination of the volume and quality of entrepreneurial activity. The inclination of would-be entrepreneurs to avoid non-entrepreneurial jobs in the production of already existing consumer goods in favor of entrepreneurial jobs in the development of new goods causes a contraction of the supply of consumer goods and an expansion of the supply of entrepreneurial projects (with corresponding effects on interest rates and wealth accumulation). Hence, it is not obviously bad economics to admit the possibility that some economies, for example those in continental western Europe, suffer low entrepreneurial activity not solely because of poor profit prospects or, conceivably, poor financial institutions, but because they have a low level of "entrepreneurial spirit." (The possibility this is so does not mean it is so, of course.) Furthermore, there is the possibility of variability through time in the strength of this spirit.²⁸ Spirits may be subject to wide swings.

The structuring of innovation finance

I move on now to another aspects of the interaction of partially ignorant financiers with entrepreneurs bearing new projects -- the sort of contract between entrepreneur and financier that would create suitable incentives for the entrepreneur in the present context where the financier faces the *ambiguity* of what the entrepreneur is able and willing to explain. Would a suitable contract entail bond financing by the venture capitalist or other financier? Or, say, convertible preferred stock? Or what? Relatedly, do contracts that provide a suitable "incentive reward" have the effect that "incentive wages" have in the labor market -- namely, to lead to better incentives though at the cost of creating an equilibrium at non-market-clearing terms? This is part of the ground being explored in work that Max Amarante and I are currently doing.

Tentatively, it appears that neither complete reliance on convertible preferred stock nor complete reliance on debt finance nor on a combination of the two can perfectly align the interests of the entrepreneur and the financier. An optimal contract is not knowable in an exact way. But maybe the features possessed by an optimal contract, in very simple settings at any rate, could be deduced.

It is also beginning to appear that financier will offer the entrepreneur incentive arrangements not offset by a compensated decrease of the entrepreneur's salary. Do financiers drive up the terms of the standard contract, causing it to be more expensive than in the neoclassical Fisher-Tobin theory, so that there will be few entrepreneurs financed (and more financiers supply themselves to the venture capital market)? The classic incentive problem may be the possibility the entrepreneur will run off with the money to Mexico. That problem is largely solved, however, by the introduction of

²⁸ An example is Martin Wiener, *English Culture and the Decline of the Industrial Spirit*, Cambridge University Press, 1981. See too Mancur Olson, *The Rise and Decline of Nations*, Yale University Press, 1982.

sequential features into the contract.²⁹ But the answer is yes in so far as the incentive arrangements are a sort of second-best solution to problems of entrepreneurs' self-dealing in ways that are difficult or impossible to "monitor" or detect.³⁰ It seems to me, however, that the presence of performance-related bonuses does *not* necessarily lead to a failure of the market for entrepreneurs to "clear," just as the practice of paying according to output ("piecework"?) does *not* lead to involuntary unemployment.

Regarding incentive-compatible contracts, it should be remarked that they create a channel through which the entrepreneur's wealth works in the opposite way to what was suggested earlier: The *wealthier* the entrepreneur, the *harder* it is for financiers to *motivate* him to make a highly stressful level of effort and to *incentivize* him not to engage in self-dealing. This incentive consideration, taken alone, operates to make entrepreneurial activity *decrease* with increased wealth in the hands of entrepreneurs. A similar effect from an adverse economic culture could result.

Concluding Remarks

To conclude: The ongoing research I have discussed is aimed at modeling capitalism along the lines developed by Schumpeter, Knight, Hayek and M. Polanyi. In this theory, business entrepreneurs originate new commercial ideas inspired in large part by their specialized knowledge and idiosyncratic experience. Then they seek the backing and advice of an experienced and specialized financier of like mind, obtained through meetings and a contract negotiated in the "innovation market." Once a new product or method is developed and launched, they market it through attempts to spark win the acceptance and assimilation of the new idea among prospective users.

Thus capitalism is portrayed as a system for producing and using new ideas, which could be represented as new models of the economy (or a piece of it). A financier bands together with an entrepreneur if the former finds sufficient affinity for the latter's model.

I am painfully aware that my results may seem unrealistic or quaint. Yet purely institutional models of innovation – models that leave out the people engaged in the innovations – tend to leave out the above considerations. We can't afford to leave out of our models ideas and the people involved with them:

Entrepreneurship, innovation and capitalism will make it into economics classrooms only with the arrival of 'abstract, formal' treatments. When those arrive, economics – and capitalism – will receive a huge boost.

²⁹ An early paper on sequential contracting is Richard Nelson and Thomas Marschak, "...".

³⁰ There is an argument to that effect in Phelps, *Political Economy: An Introductory Text*, Norton, 1985. See also theoretical modeling to this end in work by Joseph Stiglitz.