Laboratory of Economics and Management

Sant'Anna School of Advanced Studies
Piazza Martiri della Libertà, 33 - 56127 PISA (Italy)
Tel. +39-050-883-343 Fax +39-050-883-344
Email: lem@sssup.it Web Page: http://www.lem.sssup.it/

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Technological innovation, institutions and human purposefulness in socioeconomic evolution: A preface to Christopher Freeman "Systems of Innovation. Selected Essays in Evolutionary Economics"

Giovanni Dosi*

*Scuola Superiore Sant'Anna

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Technological innovation, institutions and human purposefulness in socio-economic evolution: A preface to Christopher Freeman "Systems of Innovation. Selected Essays in Evolutionary Economics"

Giovanni Dosi *

* Scuola Superiore Sant'Anna, Pisa, and Visiting Professor, University of Manchester

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Being asked to write a preface to Chris Freeman's *Selected Essays* has been for me an honour and a privilege. Chris has been for almost thirty years a loved friend, an influential mentor and an extremely insightful collaborator. However, he does not need any introduction. As one of the most prominent founding fathers of the economics of innovation as a distinct sub-discipline of social science and as influential *maître-à-penser* within and outside evolutionary economics and economic history, he would have deserved for quite a while the most prestigious recognition in economics, together with social scientists like G. Myrdal, K. Arrow, H. Simon, D. North, and a few other seminal contributors to the contemporary "political economy". A preface praising the intellectual achievements of Chris Freeman would inevitably be both partial and redundant. Rather, it might be more useful, especially for the younger readers, to briefly flag some of the themes discussed in the essays which follow and highlight the ways they relate to the ongoing evolutionary research programme in economics as well as other streams of socio-economic analysis.

Chris Freeman (together with a small number of scholars on the other side of the Atlantic – prominently Richard Nelson and Nathan Rosenberg) has established the very foundations of the economic analysis of scientific and technological research and of the ways technological knowledge becomes incorporated into new products and processes and ultimately turns out as a fundamental engine of economic growth. Freeman has been indeed one of the pioneers investigating difficult but fundamental questions such as the inter-relation between scientific and technological advances, the characteristics of innovating firms, the nature of institutions supporting technological innovation: the reader is still going to find fresh insight in the old Freeman (1962) and (1993), Freeman et al. (1963) and (1965), while of course the classic Freeman (1982) and (1994) are a must in the field of economics of innovation.[1]

The foregoing analyses are also at root of the essays which follow. However the emphasis of most of them (and also of Freeman (1987)) is on the institutions grounding "capitalism as an engine of progress" as Nelson (1980) put it.

A major theme which offers a unifying thread across the essays, and also provides the title of the collection, concerns the nature of systems of innovation and in particular *National Systems of Innovation and of Production* (hereafter NSIP). In fact, a careful reading of the following essays and more emphatically the conclusions reveal that NSIP are for Freeman a privileged level of analysis of the interactions and co-evolutionary dynamics among five sub-domains, and related institutions, governing

i. the generation of scientific knowledge;

ii. the development, improvement, adoption of new artefacts and new techniques of production (that is, the domain of technology);

iii. the "economic machine" which organizes the production and distribution of goods, services and incomes;

iv. the political and legal structure; and finally,

v. the cultural domain-shaping values, norms and customs.[2]

[1] For a reconstruction of some elements of the history of the "economics of science", see Nelson (2006)

[2] In fact, as Chris Freeman implicitly suggests – and I happen to agree – it is at national level where the interaction among these five domains appears more clearly. See also Nelson (1993) and Lundvall (1993). This does not mean to say that a germane notion of systems of innovation cannot be fruitfully applied at sectoral level: on the latter, see Malerba (2004)

It is indeed a formidably challenging research programme, posing basic interpretative questions, at the same level of generality – even if different in their ingredients – as the "theories of history" addressed by A. Smith, Marx, Weber, Keynes and Schumpeter, among a few distinguished others. One could call it the "grand political economy", trying to answer some of the questions which, frankly, I consider to be among the ultimately interesting ones: what has triggered and what keeps the momentum to self-sustained exponential growth in developed economies since the Industrial Revolution? How do we explain the patterns of catching-up, falling-behind and forging-ahead historically observed among different countries? What are the factors underlying the long-term fluctuations in the time profile of economic aggregates such as GDP, productivity, employment, etc. at both "world" and national levels? What is the relative importance, in the answer to the foregoing questions, of technological vs. organizational vs. institutional factors?

Chris Freeman's conjectures together with his enormously insightful exercises of "appreciative theorizing" – as Nelson and Winter (1984) call the *genre* of bottom-up history-based interpretations – are nearly opposite to any quest for the "magic bullet" enterprise. Hence, as Chris remarks in the conclusions, the "ultimate driver" of socio-economic history is unlikely to be an invariant Marxian tension between "forces of production", "relations of production" and "political/ideological superstructures". By the same token, one is equally unlikely to find any ultimate "Schumpeterian driver" of long-term growth just based on technological innovation – as important as it is – always holding irrespective of the (institutional and cultural) context conditions. And, needless to say, any account of the magic bullet in terms of "just get the incentives right and you will be OK" is so far away from Chris' views that he does not even mention it (I happen to fully agree with him, but I shall briefly get back below to the issue since it features such a big part in the contemporary "spirit of the times" in social sciences).

C. Freeman's first fundamental conjectures entail that each of the foregoing domains of analysis maintains a good degree of "evolutionary autonomy": to give a few examples, science to a significant extent (even if not fully) evolves according to its own selection criteria; so do political institutions and cultural traits; collectively shared norms might well self-reinforce even when driving to technological downgrading and income deterioration; and the list is much longer.

The second interpretative conjecture, further developed also in his joint works with Carlota Perez and Francisco Louça (cf. among others Freeman and Perez (1988) and Freeman and Louça (2001)) is that the observed dynamic properties of the various (national) economies and their relative performances as well as the dynamics of international economy as a whole, ought to be interpreted in terms of *congruence* (or. alternatively, varying degrees of *mismatching*) among the foregoing subdomains. Ambitious as it is, I find the elements of a "theory of contemporary history" sketched out in Freeman and Perez (1988), Perez (2002), Freeman (2002), Freeman and Louça (2001) both highly suggestive and quite convincing. In such an interpretation the national specificities in the coupled dynamics among the five above domains account for e.g. the English emergence to leadership in the first Industrial Revolution, the subsequent catching-up and forging-ahead of the USA and Germany, all the way to the contemporary success of far-eastern economies like Korea. It is an interpretation which bears major overlappings with the – to a good extent French – "regulation school" (see Boyer (1988a) and (1988b), and, among the non-French contributors, Dosi and Orsenigo (1988), and also Coriat and Dosi (1998), for discussions of the links between such a breed of institutionalism and evolutionary theories in economics). If anything, there is relatively more emphasis upon science and technology in Freeman and colleagues and more emphasis on politics, conflict and governance institutions in Aglietta, Boyer, Coriat, and other "regulation"

colleagues. However, this should be a second-order issue, in principle to be clarified on the grounds of finer comparative historical evidence.

Some basic "congruence" or "combinatorics" story is also at the core of the *variety of capitalism* approach to the comparative assessment of the political economies and revealed performances of e.g. "laissez-faire" Anglo-Saxon capitalism vs. "corporatist", German or Japanese, breeds of capitalist socio-economic organization (cf. Hall and Soskice (2001), and also Cimoli et al. (2006) on development patterns). And, finally, C. Freeman's history-based generalizations are well in tune with more formal explorations of the *consistency properties* (or lack of them) among forms of governance of information, incentives, financial flows and product markets (cf. the seminal work of Aoki (2001); for some links with evolutionary theories of technological change see also Aoki and Dosi (1992)).

A major methodological element shared by Freeman and colleagues with these other streams of analysis is the explicit focus upon *comparisons among discrete institutional forms*[3], which distinctly combines mechanisms of knowledge generation and of governance of economic coordination. So for example, in M. Aoki and co-authors the archetypal "Japanese firm" differs from the archetypal "American firm" in terms of distinct organizational attributes determining among other features the way information flows across the hierarchical layers of the firm, the relationships between internal promotion mechanisms and modes of access to the labour market, and the links between the firm itself and finance (Aoki (2001)).

The emphasis of Aoki et al, as well as "variety-of-capitalism" streams of analysis, is largely, although not exclusively, *cross-sectional*, addressing the structural differences between, say, the US, Japan, Germany and Sweden over the last fifty years or so. The recurrent question is whether such differences, even if they existed in the past, will continue to exist in the "globalization era". Chris Freeman convincingly argues that they will. I fully agree with him and shall add some brief comments below. Come as it may, Freeman puts an even greater emphasis on the *historical* evolution of distinct political-economy regimes associated with distinct techno-economic paradigms shaping the overall organization of knowledge accumulation and production under e.g. an electricity-/internal-combustion/mass production mode vs. an ICT-driven one (cf. Freeman and Perez (1988), and Freeman and Louça (2001) among others) .

I cannot enter here into the details of the overlaps and differences between different analyses however grounded into some institutional combinatorics concerning the performance comparisons between different "institutional types" and the assessment of their genesis, mechanisms of self-maintenance and evolution. The common bottom line is the focus upon the identification of the combinations which make, say, the "research university" mode of generating scientific knowledge congruent with the modes of its industrial exploitation which in turn might or might not be congruent with the ways labour and financial markets work, etc. From a modelling point of view one is still at the beginning, but the already mentioned works by Aoki and colleagues offer suggestive hints (see also Marengo (1992) for a largely unexploited style of micro institutional comparisons). In any case, note that in such a style of analysis, complementarities –or lack of them– and congruence –or mismatching– are the name of the game. Hence, to illustrate, in such a perspective it might not come as a surprise, say that "Confucianism" under some institutional set-ups might appear as a hindrance to industrial development while in others might be a source of "progressive" social norms; that "labour market rigidities" in some contexts are just "rigidities" while in others are powerful drivers to within-firm knowledge accumulation and cooperative behaviours…

[3] The merits of such methodology, on more microeconomic grounds, are stressed also by Williamson (1999)

To repeat, let me emphasize the still preliminary stage of such types of formal analysis – as distinct from a long and noble pedigree of "qualitative" historical analyses, ranging from A. Smith to C. Cipolla, from Marx to Landes, from M. Weber to R. Dore, indeed to Chris Freeman. As an almost symmetric opposite term of comparison, many of the younger readers are certainly familiar with the "political economy" with solid formal neoclassical roots (for a thorough statement see Persson and Tabellini (2000)). Call it the "Neo Political Economy" (NPE). In the NPE world, one studies the equilibrium effects of different policies and political set-ups grounded in rational responses of invariantly maximizing agents. Philosophically germane to that stream of analysis is the search for some sort of invariant "meta-production function" that is supposed to parsimoniously describe the transformation of whatever "inputs" which might range from physical capital investment all the way to the protestant ethic, the propensity to reproduce, the resistance to malaria, the degrees of education, the distance from the equator, etc. into some socio-economic performance "output". (A concise example of the *genre* is Sachs and Warner (1997); elements of caution on the outcomes of the whole exercise are in Easterly (2001)). The device is simple and deceivingly innocent: in fact, on a couple of occasions even Chris Freeman in the essays which follow makes a heuristic use of production functions of the kind! Personally, I am all in favour of the search for statistical regularities possibly characterizing the development process and its underlying political economy. However, as I voiced earlier my scepticism regarding the quest for the "magic bullet" explanations, I am equally sceptical about the enterprise of estimating some kind of "meta-recipe" able to sort out the relative contributions of e.g. democracy, degrees of distributional inequality, knowledge, the rule-of-law, etc. within some invariant "meta-cuisine" (as extreme in that vein, I once heard a very famous economist presenting his own "theory of history" grounded into a production function which was supposed to be invariant in its functional form from the Stone Age to the present!). In fact, in a world ridden with complementarities the search for the "meta-recipe" looses much of its interpretative power. [4]

What does one do then? Well, first, we should all continue and refine upon the exercises of "reasoned history" of which Chris Freeman has offered convincing templates. Second, we certainly should refine our knowledge of the stylized facts of development, trying to identify the invariances and the discontinuities both in time series and cross-sectionally across different groups of countries (building upon some of the early classic contributions of Burns, Mitchell, Kuznets and Kaldor, and adding novel microeconomic knowledge; on this point see also Dosi, Freeman and Fabiani (1993)). A third, complementary, line of investigation, involves in my view the construction of models –"as simple as possible, but not simpler", as Einstein once put it!– able to generate (and thus, in some sense explain) the foregoing "stylized facts". Not surprisingly my preference goes for models of an evolutionary kind but I wholeheartedly welcome a healthy competition between evolutionary and more mainstream models aimed at interpreting a commonly recognized set of phenomena, ranging from the long-term properties of the time series of economic aggregates such as GDP, productivity, employment, etc. all the way to micro phenomena such as those concerning the patterns of innovation, corporate performance, and the dynamics of industrial structures.

The subtitle of Chris Freeman's selection of writings is "Essays in evolutionary economics". They are in fact genuinely "evolutionary" at least in the sense of the evolutionary research programme whose building blocks one tries to spell out in different ways in Nelson and

[4] And of course, the fact that one is able to estimate interaction terms is a far cry from the "combinatorics" property that, say, A when together with B and C might have a beneficial effect on growth while it may have a negative one when it comes just together with C and in presence of D. For a similar argument concerning the simpler domain of production theory, cf. Dosi and Grazzi (2006)

Winter (1982), Dosi and Nelson (1994) and Dosi and Winter (2002). At a first look, the spirit of Freeman's essays significantly differs from a good deal of contemporary evolutionary contributions, which mostly address micro and industry-level aspects of technological and organizational change (although not exclusively: for recent assessments also covering progress in the – formal and "qualitative" – understanding of growth as an evolutionary process, cf. Nelson and Winter (2002) and Verspagen (2005)). In my view, there is indeed a fundamental complementarity between micro investigations and the more macro perspective running through Chris' essays. In fact, the latter are remarkable examples whereby thoroughly evolutionary micro stories are the underlying thread of the much broader, macro co-evolutionary histories. In Freeman's world this running back and forth between the micro, the macro and the range of complementary institutions is natural, as it should be. So the reader will appreciate in the essays that follow insightful pieces of analysis of the painstaking emergence of the ICT-centred techno-economic paradigm and of the national specificities influencing the modes and rates of its diffusion. In all that, as already mentioned, Chris Freeman's thesis is that also in "globalization era" nations (and "quasi nations", such as the European Union) will continue to play a fundamental role as entities driving policy-making and institution-building. As so will the "visible hand" of large enterprises play such a role, even if their organizational structure and their sectors of principal activity are changing as compared to the earlier "Fordist" electro-mechanical paradigm.

I was mentioning the fact that Chris Freeman's works – those reproduced in this book and his whole production – are a template of an analytical style continuously relating micro events (say, specific innovations), "meso" dynamics (e.g. the competitiveness and the patterns of evolution of particular industries) and macro patterns concerning income growth, employment, relative success/decline of particular countries. Such a style of analysis is indeed too rare a virtue, also in the evolutionary camp. As a correlate, even in the latter there is far too little reflection on the broad collective implications of the dynamics of innovation, "creative disruption" and industrial evolution. Putting it telegraphically, in the large fuzzy "evolutionary community" – in my view – there is a bit too much Schumpeter and far too little Keynes. And the imbalance is so high that sometimes one suspects that some evolutionary scholars are not too uncomfortable to see all their micro-foundations summarized by, say, some neat equilibrium trajectory at macro level. And some might not even shiver at the *mother of all evolutionary mistakes*, that is M. Friedman's "hand waving theorem" re-stating Mr. Pangloss' proposition that "everything we observe must be optimal, otherwise any superior competitor would have wiped it out…". At this point in time, one ought to leave one of the numerous falsifications of the statement to graduate students: however, for those just educated in Chicago and intellectual surroundings, early criticisms are in Winter (1964) and (1975).

Chris Freeman on the contrary belongs to that group of evolutionary scholars who believes in the widespread possibility of multiple evolutionary paths (incidentally note that such multiplicity erodes any interpretative value to the proposition that evolution is a sort of decentralized optimization device: more on it in Castaldi and Dosi (2006)). Chris, if I understand him well, is quite comfortable with varying degrees of path-dependence in technological and institutional dynamics. In fact I trust he is quite comfortable with Paul David's proposition that "institutions are carriers of history" (David (1994)) with all the inertia that they entail. Granted that, the whole – personal and intellectual –history of Chris Freeman has been marked by the passionate search for the degrees of freedom for purposeful human action apt to steer the evolution of socio-economic institutions toward progressive social objectives – including the international diffusion of new technologies and industrial development, equitable patterns of income distribution, employment and democratic rights,

the reduction of environmental rape. I am sure to interpret also Chris' thoughts in stating that in fact these objectives have been what motivated him and quite a few of us to understand in detail how the socio-economic machine works precisely in order to identify the levers and the "windows of opportunity" in order to change it. Chris has done a lot in this respect, trying also to spell out normative proposals at an institutional and policy level (cf. Freeman (1992), Freemand and Soete (1993) and also the essays in this volume).

Few others, in the past and in the near present have voiced overlapping objectives (see among others, Nelson (1997), Hirschman (1973 and 1995), Dore (2004), Stiglitz (2006)). However it is only fair to admit the minority role that all these voices, (indeed, our voices) have played especially over the last quarter of a century as compared to a "spirit of the time" roughly grounded into some version of the neoclassical orthodoxy, but – even more importantly – into some unquestioned faith in the "magic of the market", "put incentives right and everything will turn out in place", and other dangerous acts of faith of this sort. Chris Freeman has been one of the few who basically did not care about this tide. At last, the world is (reluctantly) sobering up from a sinister illusion whereby "globalization", "the new Economy", "more market, less policies", etc. should have been the universal panaceas. That might indeed correspond also to a "window of opportunity" at the policy level. But one will not be able to seize it if the "projects for better worlds" are not accompanied by a careful, dispassionate, rigorous analysis of the anatomy and evolution of the contemporary socio-economic fabric. This is one of the precious lessons that my friend Chris continues to give us.

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