

Endogenous growth with national innovation systems

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VALORISATION ADDENDUM

This thesis explores on ideas that connect the innovation capabilities of countries with their chances to expand income, economic growth and prosperity opportunities for all. On these grounds, the research that has been conducted here turns out to be relevant for society at large, even if only potentially and indirectly, and most probably in the distant future.

On reflection, it is fair to say that looking for immediate recognition and implementation of the fruits of academic research is complicated. Quite the contrary, particularly when it comes to the kind of fundamental research that is conducted in the field of economics, it may take a considerable length of time and transformation before new ideas are accepted and implemented in a way so that they have practical impact, and—no wonder—lots of new ideas never make it to this final stage.

Even when the results of scientific research withstand the test of time, which happens when and if they are recognized of some value, their usefulness to the profession, the economy and the society are constantly verified against the facts of reality. New theories and models are always a subject of controversy in every field of science. New ideas can and often are modified in part, or fully reformulated until nothing remains from the original, or they can be rejected after a while of popularity. But, to be sure, by no means being a subject of controversy is a minor success. After all, many of the more modest findings never make it to the controversial territory at all. It is certainly the case that controversy rather than consensus is the underlying feature that ultimately leads to the creation of new and valuable knowledge.

In brief, whether the ultimate ambition of this research to improve social prosperity is going to be reached or not, will depend on whether these ideas are found worth of controversy and dialogue by the scientific community, and whether they will be able to influence political decision at some point in the distant future. Therefore, this research is firstly intended for researchers, academics and policymakers who are interested in innovation policy, economic growth and development economics.

Since the questions related to the relationship between technology diffusion, the production of innovation, innovation policy, economic growth and development economics, have been explored in the literature from different theoretical perspectives. And those perspectives involve different justifications for the role of government in setting up the right conditions to promote an environment for innovation which, in turn, is expected to determine the ability of less developed countries to catch up, in this thesis we have proposed an organizing framework to understand how the innovation system operates in the first place.

One key lesson obtained from this framework is the need to rectify the theoretical structure from which logical policy recommendations are derived regarding the promotion of innovation as the fundamental engine of economic growth.

Specifically, we explain why it is needed to introduce within such a framework the explicit role of government alongside other features of the innovation system that we have identified and discussed within this thesis. Innovation has some of those special characteristics that K. Arrow attributed to health services, where private interest is not well defined, which let him to famously declare that even though (free) enterprise is desirable as much as possible, it would have to be supplemented with as much intervention as necessary. By its very nature, innovation does not fit in the conventional economics' rationale of perfectly foresighted maximizing individuals mainly—but not only—because innovation involves lots of uncertainty. This special characteristic implies that markets let alone would much probably produce too little innovation.

Actually, we provide a strong claim that the policy relevance of academic research on this front, namely the relationship between the promotion of innovation and long-run economic growth and catching up, is better informed by the *evolutionary* and NIS approaches to the study of development in backwards economies, and that these approaches contrast with the mainstream theory of economic growth, the distance from frontier and advantages of backwardness approaches. The point that conventional economics has failed to convincingly incorporate the economics of innovation is widely recognized by other academic economists. For instance, Edmund Phelps, a leading economist, has pointed out that, despite their sophistication in other respects, what is wrong with conventional approaches to explain economic growth is that those approaches make no room for the possibilities created by indigenous innovation, which is in open contrast with the fact of reality that everywhere people are constantly imagining new products and using their creativity to build them.

The novelty of our approach is not the introduction of the *evolutionary theory*. This theoretical perspective has been around since the very foundations of economics as a social science. Marshall, one of the founders of what we know as the *neoclassical approach*, and also various other classical economists are known to have declared in not few occasions that the advance of economics is closely related to the evolution of biological systems where both the inner and outer forms of the system are constantly changing. The famous Marshallian quote according to which “*The Mecca of the economist lies in economic biology rather than in economic dynamics*” is often presented to point out that economic phenomena can be seen as a natural process. It has “*cooperation*”, “*competition*”, “*selection*”, “*survival of the fittest*” and other many features that are also commonly found to be descriptive characteristics and processes in the field of biology.

In this thesis, we concentrate less in the analogy between biological and economic systems. But, we often use the metaphor to emphasize, even though at times implicitly, that the process of innovation is closely related to the biological process. For example, we discuss how the pressures of market selection and competition—which is triggered by consumers’ craze for the “*new*”—compel producers to permanently seek for newer market strategies and novel products. By its very nature, innovation is a process that involves permanent change as producers know that any product innovation that survive competition may do wonders for the first generation, but they do it less well for the second generation,

and still less for the third.

While real life examples of innovation are easily associated with high technological devices produced somewhere by sophisticated means and highly trained scientists working in centers of excellence of the advanced world economies, the truth is that innovation, as an engine of economic activity, is found everywhere. Kinder eggs, the popular chocolate candy that is found practically all around the world would be much less popular would not children come to realize there is a good chance of a ceaseless offer of new collectible miniature toys packed inside them. And, likewise, the baker around the corner knows—even if they probably aren't conscious of possessing such a knowledge—that rather than producing the whole stock of bakery early in the morning, a successful business depends on the smell of baking bread instead, hence, on having a permanent offer of freshly baked products all through the day.

Extending this line of reasoning to the economy wide level and to the context of international economics we reach the conclusion that, however important, technology diffusion and its adoption by backward countries would be ineffective without domestic *assimilation*, a process by which the new technology is found to have practical and profitable commercial applications. Technology acquisition matters, but the wonder of technology progress lies less in technology consumption *per se* and more in being able to put technology to productive use.

The diffusion of major technologies certainly helps to resolve the productivity problem, e.g., they help to resolve the problem of '*how to produce*'. But beyond the ability to produce more of the same products, or producing them at a lower unitary cost, the problem that remains is '*what to produce*'. This involves thinking of new product varieties able to lure new and existing customers and, more in general, thinking of novel strategies to take advantage of the commercial opportunities opened up by the newest technology breakthroughs, both in domestic and international markets. Thus, we claim in this thesis that a broad view of innovation inclusive of both *low-tech* and *high-tech* innovations is needed if we are going to gain better understanding of the process of economic growth and catching up of backward countries.

The innovation systems approach is also well established in the research into the impact of innovation on economic growth and catching up issues. In this thesis we have narrowed the numerous and some times overlapping features attributed in the specialized literature to this framework, to just three mechanisms that we consider essential and encompassing among the many desirable characteristics of a good innovation system. We call them *leadership*, *sponsorship* and *coordination* mechanisms.

We have shown that *leadership*, which relates to public innovation and collaboration with the private sector; *coordination*, which summarizes a wide range of strategies designed by the government to encourage the spread of innovation throughout the different sectors of economic activity and the different parts of the innovation system; and *sponsorship*, which copes with a broad range of public programs to financially support private innovation initiatives, are the three major defining attributes of the innovation system approach as it has been actually implemented in practical policy making in the most successful catching

up economies worldwide.

The main theme in our discussion of this framework is that knowledge of the three components of the NIS approach can be useful in formulating innovation promoting strategies. Based on this rationale, policymakers can realize that the formulation of innovation policy goes far beyond friendly regulations to foreign technology and mere financing facilities that are currently stressed in some branches of the literature, and which have become commonplace in the policy practice and growth strategies of less successful economies.

However, we have stressed also that much progress can be done in analyzing the actual economic growth and development impact of innovation by linking the insights of the evolutionary theory and the NIS framework—which are conceptually richer and more policy oriented—with the mainstream methodological and analytical framework—which is firmly established an approach to study the technical and mathematical issues that are of importance when the focus is on the economy as a planning problem over the long-run.

It is hard to know whether the ideas developed here will influence actual decision making or not at some point of time, so that they can reach the stage of social impact. A most immediate step toward this ‘major goal’ is to boost controversy and, hopefully, to make it through the contest for the “*survival of the fittest*”.

To this end, parts of the research that led to the present thesis have been submitted for publication in specialized outlets: the World Bank Economic Review, The Journal of Economic Growth, the Journal of Evolutionary Economics and the Journal of International Trade and Economic Development among others. We have obtained encouraging peer review feedback suggesting that by no means our research approach is off the mark. And also, we have managed to publish some of the submissions and others are close to being published: Perilla 2015, 2019a, 2019b. Also, we have taken part in conferences and seminars where the ideas developed in this thesis have been presented to academic communities.

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