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## **Institutions and Policies Shaping Industrial Development: An Introductory Note**

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There are two complementary ways to introduce the analysis of the institutions and policy shaping industrial development.

First, one may just build on the simple empirical observation that no example can be found in history of a process of development nested in an environment even vaguely resembling the institution-free tale of economic interactions that one finds in a good deal of contemporary economic theory. On the contrary, all historical experiences of sustained economic growth – starting at least from the English “Industrial Revolution” – find their enabling conditions in a rich set of complementary institutions, shared behavioral norms and public policies. Indeed, the paramount importance of institutions and social norms appears to be a rather universal property of every form of collective organization we are aware of. Moreover, much more narrowly, discretionary public policies have been major ingredients of national development strategies, especially in catching-up countries, throughout the history of modern capitalism: cf. the contributions by Mazzoleni and Nelson (2005), and Perez and Di Maio (2006) to this project, together with the historical experiences analyzed in the different country chapters.

Conversely, from a symmetric perspective, there are extremely sound theoretical reasons supporting the notion that institutions and policies always matter in all processes of technological learning and economic coordination and change.

Here we focus on the latter issue and outline some theoretical foundations for institution-building and policies.

### 1. **A misleading point of departure: “*market failures*”**

Conventionally, one would start from the very general question when are public policies required from the point of view of the theory and, as known, the standard answer would be “when there are market failures” of some kind. However, albeit quite common, the “market failure” language tends to be quite misleading in that, in order to evaluate the necessity and efficacy of any policy, it takes as a yardstick those conditions under which standard normative (“welfare”) theorems hold. The problem with such a framework is not that “market failures” are not relevant. Quite the contrary: the problem is that hardly any empirical set-up bears a significant resemblance with the “yardstick” - in terms of e.g. market completeness, perfectness of competition, knowledge possessed by economic agents, stationarity of technologies and preferences, “rationality” in decision-making, etc. (the list is indeed very long!). In a profound sense, when judged with standard canons, the whole world can be seen as a huge market failure!

Indeed, this is implicitly recognized in any serious policy discussion, where the argument about policy almost never is about whether the situation at hand is actually “optimal”, but rather about whether the problems with the incumbent institutional set-up are sufficiently severe to warrant active policy measures. In all that, most often the demand for “proofs for failures” mainly plays as a device to put the burden of the evidence away from the believers in the dogma that in general “more market is always better than less...”.

Much nearer the empirical realities of markets and non-market institutions which govern production, exchanges and economic coordination in modern economies, in the following we shall discuss both issues of (i) the boundaries between market and non-market forms of economic organization, and (ii) embeddedness of markets themselves into complementary non-market institutions.

## **2. A rather universal role of institutions: the determination of the boundaries between non-market and market interactions**

Which types of social activities are subject to (i) decentralized production and (ii) money-mediated exchanges, and which ones are not? There is an impressive range from the economically banal to the morally outrageous. “Strategic” goods? Pharmaceuticals? “Natural” monopolies? Public utilities? Education? Childcare? Retirement benefits? Health care? Human organs? Blood? Husbands and wives? Political votes? Children? Court rulings?

In another work one of us (Nelson (2005)) discusses precisely the *governance structure* of a few goods and services wherein their provision has often relied, in part or entirely, on non-market mechanisms.

Clearly the question of the determination of market boundaries applies to both developed and developing countries but is particularly crucial in emerging and ex-centrally planned economies where the boundaries between market and non-market institutions have still to be clearly defined. Far from the fury of market fundamentalism, our basic view there is that non-market institutions (ranging from public agencies to professional associations, from trade unions to community structures) are at the core of the very constitution of the whole socio-economic fabric. Their role goes well beyond the enforcement of property rights. Rather, they offer the main governance structure in many activities where market exchanges are socially inappropriate or simply ineffective. At the same time, they shape and constrain the behavior of economic agents toward competitors, customers, suppliers, employees, government officials, etc. In that, they are also

instrumental in curbing the "self-destruction perils" flagged long ago by Polany (1957) and Hirshman (1982).

Moreover, notice that even when one encounters a prevailing "market form" of governance, the latter is embedded in a rich thread of non-market institutions.

Pharmaceutical is a very good case to the point. Here in all countries with an effective, for-profit pharmaceutical industry, one finds government programs that support biomedical research, generally at universities and public labs. Together, the university parts of these programs are associated also with scientific training for people who after finishing their education, go on to work in pharmaceutical companies. Moreover, in virtually all countries, public funds and programs play a major role in the procurement of pharmaceuticals. And, finally, in virtually all countries there are various forms of regulation of pharmaceutical which go well beyond textbook guarantee of property rights and integrity of exchanges.

Or consider aircraft and airline services. In all countries that have a major aircraft production, government funds play a significant role in R&D. And in most countries both the airports, and the traffic control system are not only funded but run by government agencies. Even in the simple case of trucking and the use of automobiles, the public sector plays a major role: it builds and maintain roads, regulates safety and inspects vehicles, while a large share of the police is traffic police...

Indeed, even when the conditions which allow markets to work reasonably well are fulfilled – in terms of distribution of information, norms of interaction, etc. – we propose that their role should be evaluated not only in terms of allocative efficiency (whatever that means in ever-changing economies) but also as environments which continuously allow the experimentation of new products, new techniques of production, new organizational forms. In this perspective, markets, when they work, operate as (imperfect) mechanisms of selection. Also at this level, the ways the institutional architecture organizes the interactions amongst economic agents, and the ways policies regulate behaviors and forms of competition have a paramount importance.

### **3. The case of the generation, adoption and economic exploitation of new scientific and technological knowledge**

While the importance of institutions and policies is ubiquitous in all process of economic coordination and change, this is particularly so with respect to the generation and use of information and knowledge. As we know since the early works of Nelson (1959) and Arrow (1962) they are in many respects similar to a "public good" in that the use of information is

- non-rival (the fact that one uses it does not prevent the others from using it too);
- non-excludable (were it not for institutional provisions such as patent-based monopoly rights of exploitation).

Moreover, the generation of information is subject to:

- sunk, upfront costs of production, and basically zero cost of reproduction;
- if anything, there are increasing returns to its use, in the sense that the more we use it the easier it is, and, dynamically, the higher is the likelihood of learning and producing ourselves “better”, “novel”, in some sense “innovative” further pieces of information.

One should note that these very properties of information intrinsically entail phenomena of market failures, to use the jargon just criticized above (also in that marginal prices are of no guidance to efficient market allocation and equilibria might even fail to exist).

Further insights may be gained by distinguishing between sheer information and knowledge. Knowledge includes (i) the pre-existing cognitive categories which allow information to be interpreted and put to use; (ii) search and problem-solving heuristics irreducible to well defined algorithms.

All forms of knowledge have a significant tacit aspect, highly complementary to codified information, which makes them person- or organization-embodied and rather sticky in their transmission. Indeed, this is one of the fundamental reasons why technological catching-up by developing countries remains a challenging task even in an era of globalization and free-information flows.

It happens that all processes of generation of new scientific and technological knowledge as well as of technological imitation and adaptation involve a rich variety of complementary actors, often including business firms but, together, public training and research institutions, “communities of practice”, technical societies, trade unions, among others.

In a fundamental sense, institutions and policies addressing technological learning have to do with the construction of *national systems of production and innovation*.

In fact, the process of catch-up involves innovation in an essential way. The innovating activities that drive the process of course differ from the innovating that is the focus of a good deal of research on technological learning in advanced economies. The new technologies, and new practices more generally, that are being taken on board, while new to the country catching-up, generally are well established in countries at the frontier. And much of the innovation that is

required is organizational and institutional. But what is going on in catch-up most certainly is innovation in the sense that there is a break from past familiar practices, considerable uncertainty about how to make the new practice work effectively, a need for sophisticated learning by doing and using, and a high risk of failure, as well as a major potential payoff from success.

Together, the dynamics of industrialization rest upon major structural transformations which entail a changing importance of different branches of economic activity as generators of both technological and organizational innovations. The recent literature on innovation highlights the diversity in the sources of learning opportunities and their complementarities between them (Dosi (1988a), Cimoli and Dosi (1995), Mowery and Nelson (1999)). In fact in each epoch there appears to be technologies whose domains of application are so wide and their role so crucial that the pattern of technical change of each country depends to a good extent on the national capabilities in mastering production/imitation/innovation in such crucial knowledge areas (e.g. in the past, mechanical engineering, electricity and electrical devices, and nowadays also information technologies). Moreover, the linkages among production activities often embody structured hierarchies whereby the most dynamic technological paradigms play a fundamental role as sources of technological skills, problem-solving opportunities and productivity improvements. Thus, these core technologies shape the overall absolute advantages/disadvantages of each country. The patterns of technical change of each country in these technologies does not average out with the technological capabilities in other activities but are complementary to them. These core technologies often also imply the construction of basic infrastructures and networks common to a wide range of activities (such as, for example, the electricity grid, the road system, telecommunication information networks). Historical evidence strongly supports the view that self-sustained technological dynamism in catching-up countries is hardly possible without a progressive construction of a widening manufacturing sector involving also indigenous skills in a set of “core” technologies.

#### **4. Complementarities, incentives and coordination hurdles**

So far, we addressed some basic motivations underlying the policies and the institutions affecting primarily the mechanism of knowledge accumulation. But what about coordination problems, stemming in a first instance from the very inter-relatedness among multiple heterogeneous agents?

Of course, the distinction is not as clear as that: “coordination” involves also demand (“Keynesian”) feedbacks, and requires reasonable degrees of incentive compatibility among agents as well as coordination in learning processes. However, the fundamental “coordination” issues here are that of

matching between decentralized behaviors, the radically different outcomes that such processes might entail depending on the institutions in which they are nested, and the importance of policies in all that.

Interestingly, the basics are quite clear to some founding figures of development economics as a discipline (Including Nurske, Gerschenkron, Rosenstein - Rodan, Hirschman and Prebisch).

Consider the following remarks by Nurske (1952):

“in our present context it seems to me that the main point is to recognize how a frontal attack of this sort - a wave of capital investments in a number of different industries - can economically succeed while any particular industry may be blocked or discouraged by the limitation of the pre existing market. Where any single enterprise might appear quite inauspicious and impracticable, a wide range of projects in different industries may succeed because they will all support each other, in the sense that the people engaged in each project, now working with more real capital per head and with greater efficiency in terms of output per man-hour, will provide an enlarged market for the products of the new enterprises in other industries. In this way the market difficulty, and the drag it imposes on individual incentives to invest, is removed or at any rate alleviated by means of a dynamic expansion of the market thorough investment carried out in a number of different industries” (Nurske (1952), pp. 13-14).

And by Gerschenkron (1952):

“industrialization process begun only if the industrialization movement can proceed, as it were, along a broad front, starting simultaneously along many lines of economic activities. This is partly the result of existence of complementarity and indivisibilities in economic process. Railroads cannot be built unless coal mines are opened up at the same time; building half a railroad will not do if an inland center is to be connected with a port city. Fruit of industrial progress in certain lines are received as external economies by other branches of industry whose progress in turn accords benefit to the former. In viewing the economic history of Europe in the nineteenth century, the impression is very strong that only when industrial development could commence on a large scale did the tension between the preindustrialization conditions and the benefits expected from industrialization become sufficiently strong to overcome the existing obstacles and to liberate the forces that made for industrial policies” (Gerschenkron 1952, 10-11)

Similar insights are behind Rosenstein – Rodan’s *big push* theory (Rosenstein – Rodan (1943); cf. also the contemporary revisitation in Murphy, Shleifer and Vishny (1989)): as one discusses in Hoff and Stiglitz (2001), a crucial feature on which the relevance of big push models rest is diffused externalities, where the interaction effects occur through system wide variables such a aggregate demand, industrial demand for inputs, or search costs.

These are all domains where appropriate mixes of policies may and do help – as historical experiences have shown – to “delock” from the past and foster novel developmental trajectories. It

has been so in the past, and, as we shall argue below, there is little reason to believe that it will be radically different in the future, notwithstanding so-called "globalization".

Indeed, institutions can be seen as the social technologies (Nelson and Sampat (2001)) mastering externalities and matching/mismatching patterns between innovative activities, underlying incentives structures, investment, saving propensities, labor training, and socially distributed skills. In turns such externalities and complementarities are mediated through changes in the institutions governing interaction rules among agents, in their beliefs and information they may access, in their “ethos” and behavioral rules (For a more detailed discussion, see Hoff and Stiglitz (2001)).

## **5. The institutional development of technological capabilities, organizations and incentive structures: a co-evolutionary dynamics**

A fundamental element in countries that successfully caught-up with the leaders during the 19<sup>th</sup> and 20<sup>th</sup> centuries was active government support of the catch-up process, involving various forms of protection and direct and indirect subsidy. The guiding policy argument has been the need of domestic industry in the industries of the day judged critical in the development process for some protection from advanced firms in the leading nations. Alexander Hamilton’s argument (1791) for infant industry protection in the new United States was virtually identical to that put forth decades later by Friederich List (1841) regarding Germany’s needs. Gershenkron’s (1962) famous essay documents the policies and new institutions used in Continental Europe to enable catch-up with Britain. The same story also fits well with the case of Japan, and of Korea and Taiwan somewhat later. In many countries these policies engendered not successful catch-up but a protected inefficient home industry. However, they also were the hallmark during the 20<sup>th</sup> century of all the countries that have achieved their goals of catching-up.<sup>1</sup> We need to learn more about the circumstances under which infant industry protection leads to a strong indigenous industry, and the conditions under which it is self defeating, and indeed several contributions to this project shed new light on the issue.

These policies obviously angered companies in the leading countries, and their governments, particularly if the supported industry not only supplied its home market but began to invade the world market. While the case made after World War II for free trade was mostly concerned with eliminating protection and subsidy among the rich countries, and at that time there was sympathy for the argument that some infant industry protection was often useful in developing countries, the

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<sup>1</sup> For a broad historical overview of the role of policies in some now-developed countries, see Reinert (2004)



more recent international treaties that have been made increasingly have been used against import protection and subsidy in countries seeking to catch-up from far behind.

Our belief is that Hamilton and List were and continue to be right that successful catch-up in industries where international trade is considerable requires some kind of infant industry protection or other modes of support.

Second, during the 19<sup>th</sup> and early 20<sup>th</sup> century, many developing countries operated with intellectual property rights regimes which did not restrict seriously the ability of their companies to in effect copy technologies used in the advanced countries. There are many examples where licensing agreements were involved, but we believe that for the most part these were vehicles through which technology transfer was effected for a fee or other considerations, rather than instances of aggressive protection of intellectual property by the company in the advanced country.

Like infant industry protection and subsidy, conflicts tended to emerge largely when the catching up company began to encroach onto world markets, or even to export to the home market of the company with the patent rights. Increasing instances of this clearly were a major factor in inducing the treaty on Trade Related Intellectual Property Rights. But this treaty makes vulnerable to prosecution not just companies in developing countries that are exporting, but also companies that stay in their home markets.

Given that, what are the different domains of policy intervention and how do they map into different policy measures and related institutions?

Table 1. summarizes an exploratory taxonomy.

In the last resort, policies and other activities of "institutional engineering" affect together (i) the technological capabilities of individual and corporate organizations, and the rate at which they actually learn; (ii) the economic signals that they face (including of course profitability signals and perceived opportunity costs); (iii) the ways they interact with each other and with non-market institutions (e.g. public agencies, development banks, training and research entities, etc.)

**Table 1. Some classification of the variables and processes which institutions and policies act upon (in general and with particular reference to technological learning)**

<b>Domains of policy intervention</b>	<b>Policy measures</b>	<b>Related institutions</b>
(i) Opportunities of scientific and technological innovation	Science policies, graduate education, “frontier” technological projects	Research universities, public research centers, medical institutes, space and military agencies, etc.
(ii) Socially distributed learning and technological capabilities	Broader education and training policies	From primary education to polytechnics, to US-type “land-grant colleges”, etc.
(iii) Targeted Industrial Support Measures, affecting e.g. types of firms, etc. – <i>in primis</i> the nature, structure, ownership, modes of governance of business firms (e.g. domestic <i>vs.</i> foreign, family <i>vs.</i> publicly owned companies, etc.)	From the formation of state-owned firms to their privatization, from “national champions” policies to policies affecting MNCs investments	State-owned holdings, public merchant banks, public “venture capitalist”, public utilities
(iv) The capabilities of economic agents (in the first instance business firms) in terms of the technological knowledge they embody, the effectiveness and speed with which they search for new technological and organizational advances, etc.	cf. especially points (ii), (iii) and also R&D policies; policies affecting the adoption of new equipment, etc.	
(v) The economic signals and incentives profit-motivated agents face (including actual and expected prices and profit rates, appropriability conditions for innovations, entry barriers, etc.)	Price regulations; tariffs and quotas in international trade; Intellectual Property Rights regimes, etc.	Related regulatory agencies, agencies governing research and production subsidies, trade controlling entities
(vi) Selection mechanisms (overlapping with the above)	Anti-trust and competition; entry and bankruptcy; allocation of finance; markets for corporate ownership; etc.	Anti-trust authorities, institutions governing bankruptcy procedures, etc.
(vii) Patterns of distribution of information and of interaction amongst different types of agents (e.g. customers’ suppliers, banks, shareholders, managers, workers, etc.)	Governance of labor markets, product markets, bank-industry relationships, etc. all the way to collectively shared arrangements for within-firms information-sharing mobility and control, forms of cooperation and competition amongst rival firms, etc. (cf. for example the historical differences between Japanese <i>vs.</i> Anglo-Saxon firms)	

It happens that all major developed countries present indeed relatively high degrees of intervention – whether consciously conceived as industrial policies or not – that affect all the above variables. And this applies, even more so, to the period when today’s developed countries were catching-up with the international leader. What primarily differentiate the various countries are the instruments, the institutional arrangements and the philosophy of intervention.

In another work, one of us considers the case of Japanese policies, especially in relation to electronic technologies, after WW II, as a paradigmatic example of catching-up policies (Dosi, 1984).

Interestingly, Japan appears to have acted comprehensively upon all the variables categorized in our taxonomy above. A heavy discretionary intervention upon the structure of signals (also involving formal and informal protection against imports and foreign investments) recreated the “vacuum environment” that is generally enjoyed only by the technological leader(s). However, this was matched by a pattern of fierce oligopolistic rivalry between Japanese companies and a heavy export orientation which fostered technological dynamism and prevented any exploitation of protection simply in terms of collusive monopolistic pricing.

It is tempting to measure this Japanese experience - notwithstanding, recent, mostly macroeconomic difficulties - with others, on average less successful, such as the European ones, which heavily relied upon one single instrument, financial transfers (especially R&D subsidies and transfers on capital account), leaving to the endogenous working of the international market both the determination of the patterns of signals and the response capabilities of individual firms. Certainly, there are country-specific features of the Japanese example which are hardly transferable. However, that case, in its striking outcome, points at a general possibility of reshaping the patterns of “comparative advantages” as they emerge from the endogenous evolution of the international markets.

The comparison between the experience of Far Eastern countries and Latin American ones is equally revealing (cf. Amsden (1989) and (2002), Wade (1990), Kim and Nelson (2000), Dosi, Freeman and Fabiani (1994), among others).

In a nutshell, Korea - as well as other far-eastern economies - has been able to “twist around” absolute and relative prices and channel the resources stemming from “static” comparative advantages toward the development of activities characterized by higher learning opportunities and demand elasticities (Amsden (1989))<sup>2</sup>. And they did that in ways which penalized rent-seeking behaviors by private firms. In fact, the major actors in technological learning have been large

business groups - the chaebols – which were able at a very early stage of development to internalize skills for the selection of technologies acquired from abroad, their efficient use and their adaptation and, not much later, were able to grow impressive engineering capabilities (cf. Kim (1993)).

This process has been further supported by a set of institutions and networks for improving human resources (Amsden (1989)). All this sharply contrasts with the Latin American experience, where the arrangement between the State and the private sector has often been more indulgent over inefficiencies and rent-accumulation.

Ultimately, success or failure appears to depend on the combinations of different institutional arrangements and policies, in so far as they affect learning processes by individuals and organizations, on the one hand, and selection processes (including of course market competition), on the other.

Certainly, the historical experience shows a great variety of country and sector-specific combinations between the types of policies illustrated above. Some subtle regularities nonetheless emerge.

First, a regularity, holding from 19th century Europe and US all the way to contemporary times, is the centrality of public agencies, such as universities, and public policies in the generation and establishment of new technological paradigms.

Second, and relatedly, “incentives are often not enough”. A crucial role of policies is to affect the capabilities of the actors, especially in the foregoing case of new technological paradigms, but also in all cases of catching-up whereby no reasonable incentive structure might be sufficient to motivate private actors to surmount big technological lags.

Third, market discipline is helpful in so far as it weeds out the low performers and rewards the high performers within particular populations of firms. However, nothing guarantees that too high selective shocks will not wipe out the entire populations themselves, thus also eliminating any future learning possibility.

Fourth, policies - especially those aimed at catching-up - generally face the need to balance measures aimed at capability building (and also at protecting the “infant learner”) with mechanisms curbing inertia and rent-seeking. For example, the latter are indeed one of the major elements missing in the old Latin American experience of import substitution while the former are what is lacking under many more recent “liberalization” policies.

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<sup>2</sup> On the “perverse” importance of rent-seeking in the development process, cf. Khan (2000a) and (2000b)

There are some general points here. Historically, a successful catching-up effort in terms of per capita income and wages has always been accompanied by catching-up in the new and most dynamic technological paradigms, irrespective of the initial patterns of comparative advantages, specialization and market-generated signals.

Our conjecture is that, *ceteris paribus*, the structural need for policies affecting *also* the patterns of economic signals (including relative prices and relative profitabilities) as they emerge from the international market will be greater, the higher the distance of any one country from the technological frontier. This is what Amsden (1989) has provocatively called policies of deliberately “getting the prices wrong”. Conversely, endogenous market mechanisms tend to behave in a “virtuous” manner for those countries that happen to be on the frontier, especially in the newest/most promising technologies. This is broadly confirmed by historical experience: unconditional free trade often happened to be advocated and fully exploited only by the technologically and politically leading countries.

## **6. On some fundamental tradeoffs facing institutions and policies in learning economies**

In a world characterized by technical change (both “continuous” change along defined technological trajectories and “discontinuous” one related to the emergence of new technological paradigms), technological lags and leads shape the patterns of intersectoral and interproduct profitability signals and, thus, also the patterns of microeconomic allocation of resources. The latter, however, may affect the long-term macroeconomic dynamism of each country, in terms of both rates of growth of income consistent with the foreign balance constraint and of technological innovativeness. In the last resort, this happens because the effects of a multiplicity of signals (related to profitability, long-term demand growth and technological opportunities) upon microeconomic processes of adjustments are likely to be *asymmetric*. Whenever trade-offs between different notions of efficiency arise, “sub-optimal” or “perverse” macroeconomic outcomes may emerge. Since the *future* pattern of technological advantages/disadvantages is also related to the *present* allocative patterns, we can see at work here dynamic processes which Kaldor called of “circular causation”: economic signal related to intersectoral profitabilities – which lead in a straightforward manner to “comparative advantages” and relative specializations – certainly control and check the allocative efficiency of the various productive employments, but may also play a more ambiguous or even perverse role in relation to long-term macroeconomic trends.

In another work one of us elaborates on this point distinguishing between the notion of (i) allocative efficiency; (ii) innovative (or "Schumpeterian") efficiency; and (iii) growth efficiency of

particular patterns of production (Dosi, Pavitt, and Soete (1990)). There we agree especially in countries far from the technological frontier patterns of allocation of resources which are "efficient" on the grounds of the incumbent distribution of technological capabilities and relative prices might well entail negative long-term effects in terms of demand elasticities of the goods one country will be able to produce (the "growth efficiency") and of the innovative potential associated with that (the criterion of "innovative efficiency").

Note that these possible tradeoffs have little to do with the informational efficiency of market processes (even if, of course, various forms of informational asymmetries are likely to make things worse). Rather it is the general condition of an economic system that technological opportunities vary across products and across sectors. More precisely, within each technology and each sector the technological capabilities of each firm and each country are associated with the actual process of production and innovation in the area. Thus, the mechanisms regarding interareas where technical skills will be accumulated (possibly), innovation undertaken, economies of scale reaped, etc. However, the potential for these effects differs widely between technologies and sectors. This is another aspect of the irreversibility of economic processes: present allocative choices influence the direction and rate of the future evolution of technological coefficients. Whenever we abandon the idea of technology as a set of blueprints and we conceive technical progress as a joint product with manufacturing, it is possible to imagine an economic system which is dynamically better off than otherwise (in terms of productivity, innovativeness, etc.), if it evolves in disequilibrium vis-à-vis conditions of allocative efficiency.

It is rather easy to see how a trade-off between "allocative efficiency" and "innovative efficiency" can emerge. The patterns of specialization (with their properties of allocative efficiency) are determined, for each country, by the relative size of the sector-specific technology gaps (or leads) (more in Dosi, Pavitt, and Soete (1990)). Whenever the gap is highest in the most dynamic technologies (i.e. those characterized by the highest technological opportunities), allocative efficiency will conflict directly with innovative efficiency. We would suggest that the likelihood of such trade-offs between allocative and Schumpeterian efficiencies is proportional to the distance of each country from the technological frontier in the newest, most dynamic and most pervasive technologies.<sup>3</sup>

A similar argument applies to the trade-offs between allocative and growth efficiency: ultimately countries may well end up by "efficiently" specializing in the production of commodities which a

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<sup>3</sup> Somewhat similar conclusions on the crucial importance of the distance from the international technological frontier in terms of required mix of policy measure can be drawn also on the grounds of "neo-Schumpeterian" models of growth: cf. Aghion and Howitt (2005)

relatively small or even decreasing number of world consumers wants to buy thus tightening their ability to grow consistently with some foreign balance constraint.<sup>4</sup>

Under conditions of non-decreasing (often increasing) returns, there is no straightforward way in which markets can relate the varying growth and innovative efficiencies of the various commodities to relative profitability signals for the microeconomic agents.<sup>5</sup>

This defines also a fundamental domain for policies.

A detailed understanding of, and intervention upon, patterns of signals, rules of allocative responses and forms of institutional organization of the “economic machine” are particularly important in those phases of transition from a technological regime (based on old technological paradigms) to a new one. These historical periods define a new set of opportunities and threats for each country: the patterns of international generation and diffusion of technologies become more fluid as do, consequently, the international trade flows and the relative levels of per capita income.

The contemporary economy – we believe – is undergoing such a change. In the process, comparative advantages become the self-fulfilling prophecy of a successful set of institutional actions and private strategies: *ex post*, technological and economic success makes “optimal” from the point of view of the economist what *ex ante* is a political dream.

## 7. Some tricky operational questions

Having acknowledged that, interesting lessons are likely to come from the detailed comparison of the outcomes of different combinations of institutional arrangements and policy measures as historically observed.

For example:

- what lessons can be drawn from the comparison between “import-substitution” vs. “export promotion” philosophies?
- How does capital accumulation complement technological learning?

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<sup>4</sup> In Dosi, Pavitt, and Soete (1990) and Cimoli (1988) one argues this proposition on the ground of a model nesting a Kald-Thirlwall growth dynamic onto diverse technology gaps at commodity level. A similar proposition however can be shown to hold under more conventional assumptions: see Rodrick (2005).

<sup>5</sup> Putting the same argument in a language more familiar to the economist, the widespread possibility of trade-offs between allocative, Schumpeterian and growth efficiencies arises from the fact that the general case is one of non-convexity of production and consumption possibility sets and growth-dependencies of technological advances. On the point, within a growing literature, see the complementary arguments of Atkinson and Stiglitz (1969), Arthur (1994), Dosi, Pavitt and Soete (1990), Krugman (1996), Antonelli (1995), Cimoli (1988), Castaldi et al. (2004)

- What is, more precisely, the importance of the financial sector and its relationship with industrial activities?
- How do strategies of technological acquisition based on MNCs investment compare with others relying on the growth of domestic firms?
- What are the most effective policy devices aimed at curbing rent-seeking behaviors which often emerge as a byproduct of the efforts to foster learning by domestic firms?
- What is the role of public research institutions in the process of catching-up?
- How is the latter affected by different IPR regimes?
- How do macroeconomic policies influence microeconomic behaviors and adjustment processes especially with regard to technological and organizational learning?

Indeed several of these questions - crucial to the understanding of the effectiveness of different policy combinations - are addressed by the various contributions to this *task force*.

However, possibly the trickiest question of all concerns the extent to which the lessons from the past can be useful under the current regime of international economic relations.

## **8. Policies in a “Globalized World”: the new challenges**

What argued so far, we believe, applies in general, to the generality of processing of catching-up and industrialization, notwithstanding their obvious historical variety. But what are the specific lessons which can be drawn from the most recent phase of international development?

In fact, the last couple of decades of “globalization” have gone hand-in-hand with powerful efforts to impose a policy regime grounded in rather extreme forms of economic orthodoxy, which in the case of developing countries has gone under the name of “Washington Consensus”. Of that Latin America has been an exemplar victim.

Trade liberalization, leading eventually to free trade, was a key part of such a “consensus” - sometimes imposed indeed at gunpoint. The emphasis on trade liberalization was natural: the Latin American countries it was claimed had stagnated behind protectionist barriers. Import substitution according to the same view had proved a highly ineffective strategy for development. In many countries industries were producing products with negative value added, and innovation was stifled. The usual argument - that protectionism itself stifled innovation - was somewhat confused. Governments could have created competition among domestic firms, which would have provided incentives to import new technology. It was the failure to create competition internally, more than



protection from abroad, that was the cause of the stagnation. Of course, competition from abroad would have provided an important source of competition. But it is possible that in the one-sided race, domestic firms would have dropped out of the competition rather than enter the fray. Consumers might have benefited, but the effects on growth may have been more ambiguous. Trade liberalization may create competition, but it does not do so automatically. If trade liberalization occurs in an economy with a monopoly importer, the rents may simply be transferred from the government to the monopolist, with little decrease in prices. Trade liberalization is thus neither necessary nor sufficient for creating a competitive and innovative economy.

At least as important as creating competition in the previously sheltered import-competing sector of the economy is promoting competition on the export side. The success of the East Asian economies is a powerful example of this point. By allowing each country to take advantage of its comparative advantage, trade increases wages and expands consumption opportunities. For the past 15 years trade has been doing just that - with world trade growing at 5 per cent a year, nearly twice the rate of world GDP growth.

Moreover, as the comparison between different experiences in Latin American and in the Far East shows, a free-trade shock does not automatically trigger any increase in the accumulation of knowledge and innovative capabilities. On the contrary, in a world characterized by multiple forms of localized increasing returns, greater integration may well lead to phenomena of increasing differentiation with self-reinforcement and lock-in of particular production activities, specialization patterns, technological capabilities (or lack of them): cf. the discussion above. Putting it another way, it is easy to show that a world which becomes, at some level, increasingly integrated - but not (roughly) identical in initial conditions, institutions, technological capabilities, mechanisms of economic interaction, etc. - might be subject to various forms of “local” virtuous or vicious circles, even more so than in the past.

Finally, the impact of greater integration is likely to depend on the modes through which it is implemented. The experience of many Latin American countries is a good case to the point. When macro (“globalizing”) shocks suddenly induced higher selection upon domestic firms, massive mortality of firms did often entail an apparent reduction of the productivity gap *vis-à-vis* the international frontier. But this seems to come together - at least in Latin America - with striking increases in both unemployment rates (i.e. transitions of parts of the labor force from low productivity to zero productivity states) and with tightening foreign-balance constraints to growth, in turn the joint outcome of relatively low elasticities of exports to world growth and high elasticities of imports to domestic growth (cf. Cimoli and Correa (2002)).

Certainly both the recent changes in international – political and economic – relations and the ongoing “ICT revolution” are reshaping the opportunities and constraints facing policy making and “institutional engineering” but by no means have decreased their importance. On the contrary: they demand new forms of governance which one is only beginning to explore.

So, for example, on the technological side, the characteristics of productive knowledge have nowadays changed as compared to, say, the electromechanical paradigms within which countries like Germany and the USA caught-up and overtook England nearly one century ago, and they might be also partly different from the type of knowledge – a good deal cantered on ICT – through which, more recently, Korea and Taiwan approached the technological frontier. In turn, with changes in the type of knowledge countries need to accumulate and improve upon, often come also changes in the most appropriate policy packages concerning e.g. the type of offered education; the support to national incumbent firms vs. MNCs vs. new entrants; the role of public training and research centers. Indeed, many of the contributions to this *task force* tackle these issues.

Major changes have come also in the regime of international trade and property right relation, associated with WTO, TRIPS and several bilateral agreements. The new regime, first has implied a reduction in the degrees of freedom developing countries can enjoy in their trade policies, while notably all catching-up countries in the preceding waves of industrialization could exploit a large menu of quotas, tariffs and other forms of non tariff barriers. Second, it involves a much more aggressive international policing of intellectual property rights and, thus, other things being equal, more difficulties in imitating and "inventing around" existing products and production processes - again, activities which have been at the core of the first phases of industrialization, from the US to Switzerland, to Japan, to Korea...

Hence, a fundamental policy question concerns the degrees of freedom left for discretionary public interventions supporting in different ways specific technologies, sectors and firms. How stringent are the new international constraints? Note that the answer here is likely to vary from sector to sector and from technology to technology. And it is likely to depend also on the distance of any country from the international technological frontier. For example, many African and some Latin American countries might not be directly affected by a tightening in the IPR regimes having little capabilities to imitate to begin with (although they might still be badly affected by being forced to buy e.g. drugs or software at ridiculous prices from first-world MNCs rather than from more advanced but still "imitating" countries). Conversely, tighter IPR regimes may well represent a major hindrance to more advanced catching-up countries.

Given that how easy is it to "play around" with existing rules? That is, putting it the other way round, how urgent is it to reform the incumbent international trade and IPR regimes in a "pro-developmental" perspective?

On all these issues, it is time to build a "new consensus" prominently featuring the exploration of forms of institutional governance which render knowledge accumulation and its efficient economic exploitation consistent with the multiple interests of profit-motivated agents. Such a "consensus", we suggest, is going to be based on a pragmatic view of markets whereby the latter sometimes work in a "developmental" sense, sometimes do not, and even when do work, their effectiveness cannot be separated from the contribution of supporting institutions and policies. And, last but not least, it must be a consensus sensitive to issues of equity and of access to the sharing of the benefits from growth stemming from technological and organizational learning.

The contributions to this *task force*, from different angles, indeed move us in this direction.

## Bibliography

Aghion P. and Durlauf S., (eds.), (2005), *Handbook of Economic Growth*, Elsevier, Amsterdam, forthcoming

Aghion P., and P. Howitt (2005), "Appropriate Growth Policy: A Unifying Framework", The 2005 Joseph Schumpeter Lecture, European Economic Association Congress, Amsterdam, August 25, 2005

Amsden A., (1989), *Asia Next Giant*, Cornell University Press

Amsden A., (2001), *The Rise of the Rest. Challenges to the West from Late-Industrializing Economies*. Oxford University Press, Oxford

Antonelli, C. (1995), *The Economics of Localized Technological Change and Industrial Dynamics*, Boston, Kluwer Publishers

Arrow K., (1962), "Economic Welfare and the Allocation of Resources for Invention" in R. Nelson (ed.) *The Rate and Direction of Inventive Activity*, Princeton, Princeton University Press

Atkinson A., and J. Stiglitz (1969), "A new view of technological change", *Economic Journal*, 79, pp. 573-578

Castaldi C., M. Cimoli, N. Correa, and G. Dosi, (2004), *Technological Learning, Policy Regimes and Growth in a "Globalized" Economy: General Patterns and the Latin American Experience*, Pisa, Sant'Anna School of Advanced Studies, LEM Working Paper 2004/01

Cimoli, M. (1988), "Technological gaps and institutional asymmetries in a North-South model with a continuum of goods", *Metroeconomica*, 39, 245-274

Cimoli M. and Dosi G., (1995), "Technological Paradigms, Patterns of Learning and Development. An Introductory Roadmap". *Journal of Evolutionary Economics*, Vol.5, 243-268

Cimoli, M. and Correa, N. (2002), "Trade openness and technological gaps in Latin America: a "low growth" trap", forthcoming in J. A. Ocampo (2005)

Dosi G., (1984), *Technical Change and Industrial Transformation*, London, Macmillan and New York, St. Martin Press

Dosi G., (1988), "Institutions and Markets in a Dynamic World". *The Manchester School of Economic and Social Studies*, vol.56, 119-146

Dosi G. (1988a), "Sources , procedures and microeconomic effects of innovation", *Journal of Economic Literature*, 26(3), 1120-1171

Dosi, G., Pavitt, K. and Soete, L. (1990), *The Economics of Technical Change and International Trade*, London, Harvester Wheatsheaf

Freeman C., (1982), *The Economics of Industrial Innovation*, London, Francis Pinter, 2<sup>nd</sup> ed.

Freeman C., (2004), "Technological infrastructures and international competitiveness", *Industrial and Corporate Change*, p. 541-569

Gerschenkron A., (1962),. *Economic Backwardness in Historical Perspective*, Harvard University Press, Cambridge

Greenwald B. J. Stiglitz, (1986), "Externalities in Economics with Imperfect Information and Incomplete Markets" *Quarterly Journal of Economics*, 101, pp. 229-264

- Hamilton A., (1771), "Report on the Subject of Manufactures", in Syrett H.C. et al. (1966), *The Papers of Alexander Hamilton*, vol. X, Columbia University Press, New York
- Hausmann R., J. Hwang, D. Rodrick (2005), *What You Export Matters*, CID Working Paper No. 123, Center for International Development at Harvard University, Cambridge, MA
- Hirschman A.O., (1958), *The Strategy of Economic Development*, Yale University Press, New Haven
- Hirschman A.O., (1982), "Rival Interpretations of Market Society: Civilizing, Destructive, or Feeble?", *Journal of Economic Literature*, 20, pp. 1463-84
- Hoff K., (1996), "Market Failures and the Distribution of Wealth: A Perspective from the Economics of Information", *Politics and Society*, 24, pp. 411-432
- Hoff K., and J. Stiglitz (2001), "Modern Economic Theory and Development", in Meier and Stiglitz (2001)
- Lall S., (2000), *Selective Industrial and Trade Policies in Developing Countries: Theoretical and Empirical Issues*. QEH Working Paper Series, 48
- Landes D., (1969), *The Unbound Prometheus*, Cambridge, Cambridge University Press
- List F., (1841), *The National System of Political Economy*, trans. S.S. Lloyd, London: Longmans, Green and Co.; first published in English translation, 1885
- Krugman, P.R. (1996), *The Self-Organizing Economy*, Cambridge, MA, and Oxford, Blackwell Publishers.
- Mazzoleni R, and R.R. Nelson (2005) "The Role of Research at Universities and Public Labs in Economic Catch-up", New York, Columbia University, Initiative for Policy Dialogue, Working Paper
- Meier G.M., and J. Stiglitz (eds) (2001), *Frontiers of Development Economics*, Oxford University press, Oxford/New York
- Mowery D.C., R.R. Nelson (1999) *Sources of Industrial Leadership: Studies of Seven Industries*, Cambridge University Press, Cambridge
- Murphy K. M., A. Shleifer and R. W. Vishny (1989), "Industrialization and the Big Push", *Journal of Political Economy*, 97, 1003-26
- Nelson R.R., (1959), "The Simple Economics of Basic Scientific Research", *Journal of Political Economy*, 67, 297-306
- Nelson R.R. (ed.), (1982), *Government and Technical Progress*. Pergamon Press, New York
- Nelson R.R., (1994) "The co-evolution of technology, industrial structure and supporting institutions", *Industrial and Corporate Change*, 3, 47-64
- Nelson R.R., B. Sampat, (2001), "Making sense of institutions as a factor shaping economic performance", *Journal of Economic Behavior & Organization*, 44, 31-54
- Nelson R.R. (ed.) (2005), *The limits of market organization*, Russell Sage Foundation, New York
- Nelson R.R., (2004), "Economic Development from the Perspective of the Evolutionary Theory", Mimeo, Columbia University, New York
- Nurske R., (1953), *Problems of Capital Formation in Underdeveloped Countries*, Oxford University Press, New York
- Ocampo J.A., (ed.), (2005), *Beyond Reforms, Structural Dynamics and Macroeconomic Vulnerability*, Stanford University Press, Stanford

- Ocampo J.A., (2005), "The Quest for Dynamic Efficiency: Structural Dynamics and Economic growth in Developing Countries", in Ocampo (2005)
- Perez W., and M. Di Maio (2006), "Industrial policies in Latin America in the last fifteen years: the political economy of consensus building around specific policy schemes", New York, Columbia University, Initiative for Policy Dialogue, Working Paper
- Polany K., (1957), *The Great Transformation*, Beacon Press, Boston
- Rodrik D., (1995), "Trade and Industrial Policy Reform", in *Handbook of Development Economics*, Vol. III, Behrman, J., and T.N. Srinivasan (eds.). North Holland, Amsterdam, 2925-2982
- Rodrik D., (ed.), (2003), *In Search of Prosperity: Analytic Narratives on Economic Growth*. Princeton University Press, Princeton
- Rodrik D., (2005), "Growth Strategies", in P. Aghion and S. Durlauf, (2005)
- Rosenberg N., (1976), *Perspective on Technology*, Cambridge, Cambridge University Press
- Rosenberg N., (1982), *Inside the Blackbox*, Cambridge, Cambridge University Press
- Rosenstein-Rodan P., (1943), "Problems of Industrialization of Eastern and Southeastern Europe" *Economic Journal*, vol.53, 210-211
- Stiglitz J., (1994), *Whither Socialism?*, Cambridge, Mass.: The MIT Press
- Stiglitz J., (1996), "Some Lesson from the East Asian Miracle". *World Bank Research Observer*, 11, 151-177
- Stiglitz J., (2001),. "More Instruments and Broader Goals Moving toward the Post-Washington Consensus", in *The Rebel Within*, Chang, H. (ed.), Wimbledon Publishing Company, London, pp. 17-56. (Originally presented as the 1998 WIDER Annual Lecture, Helsinki, January 1998).
- Veblen T., (1915), *Imperial Germany and Industrial Revolution*. Macmillan, London