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TECHNOLOGICAL LEARNING, POLICY REGIMES AND GROWTH: THE LONG TERM PATTERNS AND SOME SPECIFICITIES OF A 'GLOBALIZED' ECONOMY

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Introduction

The purpose of this chapter is to offer a frame of interpretation for the international patterns of technological innovation and diffusion, and their relations with income growth, in general, but with a particular emphasis on the possible role played by the so-called "globalization" processes of the last couple of decades. As such, it is meant also to offer a background for the discussions of the role of policies and of various measures of 'institutional engineering' in different countries and different historical periods presented in the chapters that follow. The field to cover is huge, and our only ambition here can be to provide a rather telegraphic set of propositions and some suggestive evidence (much more may be found in the literature we shall draw upon[1]).

It is useful to start from the broad picture and recall some basic long-term features of technological accumulation and income growth, in particular in their international dimension (Section 2). Given those secular trends, which - as we shall see – tend to display divergence as the dominant characteristics, to what extent and in which directions are they influenced by the contemporary processes coming under the fashionable and rather fuzzy heading of "globalization"? In order to address the question one requires a clarifying detour, spelling out which phenomena - true or imagined -underlie "globalization" itself (Section 3). We shall also focus on trends related to the 'ICT revolution', highlighting the still rather limited impact of the New Economy and offering an interpretation in terms of 'retardation factors' which affect the establishment of new 'techno-economic paradigms' (Section 4). Together, we investigate the impact, especially upon developing countries, of those dimensions of 'globalization' having to do with the 'diffusion' or imposition of that particular policy regime of management of macro variables and market governance, which goes under the heading of *Washington Consensus* (cf. J. Williamson (1990)). Notwithstanding relevant international differences in the implementation procedures, the general philosophy grounding such a policy archetype has ultimately involved the commitment to (i) blood-and-tears macro-stabilization policies, (ii) 'private-is-better-than-public-no-matter-what' market governance policies, and (iii) quite unconditional, *most often asymmetric*, international liberalization of trade and financial flows. In this respect, an 'experiment' – striking both from an interpretative point of view and for its

dramatic social outcomes – is offered by many Latin American countries over the past quarter of century. The evidence provides a powerful example of how *laissez-faire* policies may produce a 'vicious' growth path leading to 'low growth traps' whenever a country is not able to decrease its technology gap with respect to the international frontier and improve its trade balance at the same time (Section 4).

As we argue in Section 5, neither the contemporary evidence nor the theory supports the view that "globalization" naturally goes hand-in-hand with international convergence: in quite a few cases, the opposite holds. This supports the view that policy variables continue to be fundamental to the engineering of development processes.

Technological and income divergence as secular patterns

The basic phenomenon to start from is indeed the highly skewed international distribution of innovative activities which has emerged since the Industrial Revolution (Dosi, Pavitt and Soete, 1990) starting from previously rather homogenous conditions at least between Europe, China and the Arab World (Cipolla, 1965). It is certainly true that technological "innovativeness" is hard to measure, but irrespectively of the chosen proxy, the picture which emerges is one with innovation highly concentrated in a small group of countries. An illustration using patents registered in the US is presented in Table 3.1.

Indeed, the club of major innovators has been quite small over the whole period of around two centuries and half since British industrialization, with both restricted entry (with Japan as the only major entrant in the 20th century, and Korea and Taiwan as recent additions) and a slow pace of change in relative rankings.

At the same time, since the Industrial Revolution, one observes the explosion of diverging income patterns, starting from quite similar pre-industrial per capita level. Table 3.2 presents estimates showing that before the Industrial Revolution the income gap between the poorest and the richest region was probably of the order of only 1 to 2. Conversely, the dominant tendency after the

Industrial Revolution is one with fast increasing differentiation among countries and overall divergence. Bairoch and Kozul-Wright (1996) have discussed how the period between 1870 and 1914, taken as an era of early globalization, was already characterized by increasing divergence and concentration of high growth in a few countries only. Even in the Post World War II period, commonly regarded as an era of growing uniformity, the hypothesis of global convergence, that is convergence of the whole population of countries toward increasingly similar income levels, does not find support from the evidence (De Long (1988), Easterly et al. (1992), Verspagen (1991), Soete and Verspagen (1993), Durlauf and Johnson (1992), Quah (1996) and Castaldi and Dosi (2007), among others). Moreover, the process of divergence in incomes has speeded up over time. Clark and Feenstra (2003) claim that: "Per capita incomes across the world seemingly diverged by much more in 1910 than in 1800, and more in 1990 than 1910 – this despite the voluminous literature on exogenous growth that has stressed the convergence of economies, or, to be more precise, "conditional" convergence."(*op. cit*., p. 277).

Indeed, one finds some, although not overwhelming, evidence of *local* convergence, i.e. convergence within subsets of countries grouped according to some initial characteristics such as income levels (Durlauf and Johnson (1992)) or geographical locations. The typical patterns are impressionistically illustrated in Figure 3.1 from Durlauf and Quah (1998), showing the appearance of a two-humped distribution of countries with low (albeit positive) transition probabilities between the `poor' and `rich' clubs (and vice versa, too).

Table 3.1: US patents granted, by country of applicant and year (% of non-US recipients)

	1883	1900	1929	1958	1973	1986	1995	2007
OECD								
Australia	1.11	2.33	1.96	0.60	0.89	1.14	1.00	1.63
Austria	2.62	3.36	2.47	1.12	1.05	1.09	0.74	0.59
Belgium	1.59	1.35	1.30	1.14	1.25	0.74	0.87	0.67
Canada	19.94	10.54	10.25	7.99	5.95	4.01	4.61	4.27
Denmark	0.56	0.46	0.71	0.74	0.68	0.56	0.44	0.50
France	14.22	9.79	9.76	10.36	9.47	7.24	6.18	4.03

Germany	18.67	30.72	32.36	25.60	24.68	20.94	14.45	11.64
Italy	0.24	0.92	1.19	3.02	3.35	3.04	2.36	1.67
Japan	0.16	0.03	1.40	1.93	21.82	40.35	47.64	42.90
Netherlands	0.24	0.75	1.57	5.71	3.03	2.21	1.75	1.61
Norway	0.32	0.49	0.71	0.61	0.37	0.25	0.28	0.32
Sweden	0.95	1.32	3.19	4.64	3.37	2.70	1.76	1.36
Switzerland	1.75	2.27	4.46	8.80	5.86	3.70	2.31	1.33
UK	34.55	30.52	22.23	23.45	12.61	7.35	5.43	4.23
NICs								
Israel					0.37	0.58	0.84	1.42
Singapore					0.03	0.01	0.12	0.51
Taiwan					0.00	0.64	3.55	7.88
South Korea					0.02	0.14	2.54	8.10
Hong Kong					0.07	0.09	0.19	0.43
India					0.09	0.05	0.08	0.70
China					0.04	0.03	0.14	0.99
Latin America								
Argentina					0.12	0.05	0.07	0.05
Brazil					0.08	0.08	0.14	0.12
Mexico					0.19	0.11	0.09	0.07
Venezuela					0.03	0.06	0.06	0.02

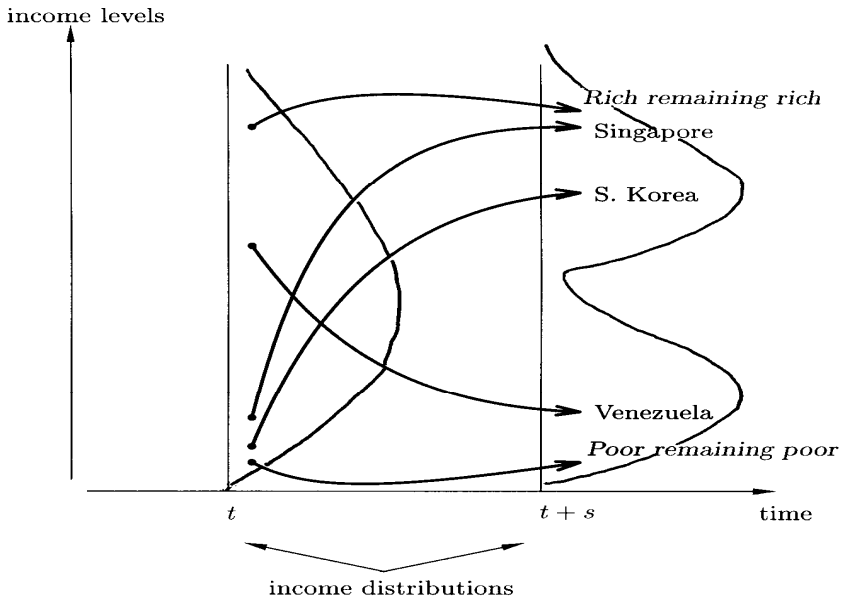
Source: elaborations on US Patent and Trademark Office (USPTO)

Table 3.2: Estimates of trends in World income: per capita GDP of regions relative to the US and Western Offshoots

Regions	1700	1820	1870	1913	1950	1973	2001
Western Europe	210	100	81	66	49	71	71
Eastern Europe	127	57	39	32	23	31	22
Former USSR	128	57	39	28	31	37	17
US and Western Offshoots	*100*	*100*	*100*	*100*	*100*	*100*	*100*
Latin America	111	58	28	28	27	28	22
Japan	120	56	30	27	21	71	77
Asia (excl Japan)	120	48	23	13	7	8	12
Africa	88	35	21	12	10	9	6
World	129	55	36	29	23	25	22

Source: Own elaborations on per capita GDP,1990 million international dollars, 1700-2001 from Maddison (2001).
Western Offshoots: Australia, Canada, New Zealand and the United States

Figure 3.1: Evolving cross-country income distributions



Source: Durlauf and Quah (1998)

Bimodality hints at a separating tendency between poor and rich countries, characterized by markedly different income levels. At the same time, the other part of the story, as discussed at length in Quah (1997), is that the same shape of a given distribution may conceal very different intra-distribution dynamics. Is it the case that poor countries have been converging to a common income level and rich countries to their own high level of income or the two modes are also the result of shifting in ranking between poor and rich countries? The issue at stake is the respective weight of persistence and mobility of countries inside the distribution. Quah (1997) finds evidence that the period 1960-1988 has been characterized by high persistence of relative rankings,

notwithstanding some important exceptions. The main events contributing to mobility have been the `growth miracles' of countries like Hong Kong, Singapore, Japan, Korea and Taiwan and `growth disasters' including some sub-Saharan African countries, but also Venezuela which was the among the first richest countries in 1960 and has dramatically fallen in the `poor' countries club.

Recent evidence on the world income distribution has shown that population-weighted measures of inequality have decreased in the last two decades, mainly due to China and India (see the discussion in Bourguignon et al (2004)). While the finding provides indeed evidence for the convergence hypothesis, it does not shed light on the increasingly frequent episodes of `marginalization' (cf. Melchior and Telle (2001)). Authors such as Dowrick and DeLong (2003) agree on the convergence of OECD economies and also within a broader group including the East Asian economies, and with China and India too after 1980. ``However, these episodes of successful economic growth and convergence have been counterbalanced by many economies' loss of their membership in the world's convergence club." (*op. cit*., p. 193).

At the same time, across-group differences in growth performances appear to be rather persistent. Likewise, one observes persistently wide and in some cases widening (such as in a few Latin American cases) productivity gaps vis-à-vis the international frontier (cf. Table 3.3 for estimates of labor productivity relative to the US). As discussed also in van Ark and McGuckin (1999) all available evidence witnesses a persistent dispersion in productivity measures. More specifically, while countries in the OECD area appeared to have moved on average closer to the US benchmark, the same cannot be said for the rest of the world.

A delicate but crucial issue concerns the relation between patterns of technical change and patterns of economic growth. Of course, technological learning involves many more elements than simply inventive discovery and patenting. Equally important activities are imitation, reverse engineering, and adoption of capital-embodied innovations, learning by doing and learning by using (Freeman (1982), Dosi (1988), Patel and Pavitt (1994)). Moreover, technological change goes often together with organizational innovation. Still, it is important to notice the existence of significant links between innovative activities (measured in a rather narrow sense, i.e. in terms of patenting and

R&D activities) and GDP per capita (for the time being, we shall avoid any detailed argument on the direction of causality), which however tend to change over different historical periods.

As discussed in Dosi, Freeman and Fabiani (1994), evidence concerning OECD countries appears to suggest that the relationship between innovative activities and levels of GDP has become closer over time and is highly significant after World War II (see Table 3.4). Moreover, innovative dynamism, measured by the growth of patenting by different countries in the US, always appears positively correlated with per capita GDP growth, even if the relation is quite noisy and period-specific (see results from Tables 3.5 and 3.6)[2].

The link is particularly robust between 1913 and 1970. Conversely, a sign that the regime of international growth might have changed in the 1970s, is that in this period the relation gets weaker and loses statistical significance. The link becomes again strong in the 1980s, loses significance again in the 1990s, and regains it in the most recent period: in our view, this is circumstantial evidence of a turbulent and uncertain dynamics in the "political economies" of different countries governing the coupled dynamics between technological learning, demand generation and growth.

In general, at least since World War II, the rates of growth of GDP appear to be closely correlated with: (i) domestic innovative activities, (ii) the rates of investment in capital equipment and (iii) international technological diffusion (DeLong (1988), Soete and Verspagen (1993), Meliciani (2001), Laursen (2000), among others). In particular Fagerberg (1988) finds a close correlation between the level of 'economic development', in terms of per capita GDP, and the level of 'technological development', measured with the R&D investment level or with patenting activity.[3]

Table 3.3: Labor productivity relative to US (real GDP in 1990 international dollars per person employed)

	1870	1913	1950	1973	1990	1998	2007
OECD							
Austria	*60.6*	*56.4*	31.4	61.4	76.7	81.7	77.1
Australia	*153.2*	*106.4*	74.2	71.7	76.3	76.6	77.3
Belgium	*96.1*	*71.9*	58.2	75.5	93.1	90.5	86.9

Canada	*75.7*	*86.9*	85.1	85.8	83.2	81.0	77.2
Denmark	*69.0*	*68.6*	59.6	66.5	74.9	76.8	75.0
Finland	*38.1*	*36.2*	34.1	53.5	70.8	77.5	79.7
France	*60.6*	*56.0*	46.3	76.4	93.7	90.8	86.0
Germany	*66.0*	*58.7*	42.9	72.2	72.5	70.9	66.8
Ireland			35.0	47.9	74.8	82.8	88.8
Italy	*45.4*	*40.6*	40.8	69.5	85.5	83.7	72.7
Japan	*20.3*	*20.9*	18.7	56.9	77.5	71.3	71.1
Netherlands	*107.8*	*80.4*	67.1	82.4	80.5	75.9	72.6
Norway	*52.7*	*46.7*	51.8	63.9	79.4	84.9	83.3
Spain		*45.0*	22.2	50.0	75.1	73.5	60.5
Sweden	*53.9*	*50.2*	57.4	68.2	69.1	74.3	76.9
Switzerland	*68.3*	*65.0*	75.5	82.4	76.6	70.2	65.2
UK	*113.9*	*84.8*	65.2	65.6	73.2	76.8	78.5
US	*100.0*	*100.0*	100.0	100.0	100.0	100.0	100.0
Latin America							
Argentina			52.4	52.9	36.1	47.4	40.7*
Brazil			23.0	27.9	21.9	22.6	19.4*
Chile			48.2	40.3	39.6	52.1	46.7*
Colombia			28.5	29.3	30.0	28.9	25.9*
Mexico			34.1	45.9	36.7	32.5	30.7
Peru			27.5	31.2	16.8	20.5	21.0*
Venezuela			97.7	92.4	54.4	46.8	46.4*
NICs							
Israel				61.2	74.1	70.5	65.7*
Hong Kong			87.0	43.3	76.8	78.9	94.7*
Singapore				39.5	58.8	64.8	74.2*
Korea			*10.7*	21.3	43.1	51.6	61.7
Taiwan			*10.9*	28.7	50.5	65.8	71.6*
India			*5.8*	6.1	6.9	9.6	18.9
China			*5.5*	4.8	7.4	8.4	10.9

Source: Total Economy Database, GGDC (2006), historical values (in italics) are from Maddison (2001). Values with the star (*) correspond to the year 2006

There is no strong evidence of convergence of innovative capabilities (PT and pt indicators in tables 3.5 and 3.6), but there is some continuing sign of convergence in income. In turn,

capability of innovating and quickly adopting new technologies is strongly correlated with successful trade performance (Dosi, Pavitt and Soete (1990)).

Moreover, despite technological diffusion taking place at rather high rates, at least among OECD countries, important specificities in “national innovation systems" persist, related to the characteristics of the scientific and technical infrastructure, local user-producer relationship and other institutional and policy features of each country (Lundvall (1992), Nelson (1993), Archibugi, Howells and Michie (2001)). In an historical perspective, Freeman (2002) convincingly argues how catch-up of countries has critically relied on the ability to build successful national innovation systems. This has been, in turn, the case for England, US, Japan and, most recently, the Asian tigers.

To repeat, the dominant tendency throughout the foregoing secular picture hints at long-term divergence in relative technological capabilities, production efficiencies and incomes. Together come however two more hopeful messages.

First, notwithstanding prominently divergent patterns, one has also witnessed secularly increasing average levels of technological knowledge within most countries, and together also in the levels of per capita income. Second, while it holds true that the ``innovators club" has been remarkably small and sticky in its membership, one ought to notice both the possibility of entry by a few successful latecomers (in different periods, the US, Germany and Japan being the most striking examples) and also the possibility of falling behind by very promising candidates to the club (cf. the vicissitudes of Argentina over the last century).

Given all that, how is such a long-term scenario affected by those recent changes of the economic and political relations in the international arena collectively coming under the name of “globalization”? In order to offer some tentative answer, one ought to start by specifying what precisely ‘globalization’ stands for.

Table 3.4: Correlation coefficients between levels of Innovative Activity and GDP per capita, OECD countries

	Correlation of GPD per capita with	
Year	US patents per capita	R&D per capita
1890	0.20	
1913	0.38	
1929	0.56*	
1950	0.63**	
1963	0.73**	0.79**
1967	0.72**	0.69**
1971	0.74**	0.71**
1977	0.88**	0.61**
1981	0.65**	0.62**
1985	0.61**	0.49*
1991	0.63**	0.68**
1996	0.50*	0.62**
2006	0.55*	0.76**

* Significance at 5% level
** Significance at 1% level *
Source: Pavitt and Soete (1981) until 1977 and own elaborations for later years.

Table 3.5: Correlation coefficient between Innovative Activity and Output, 1890-1977, 14 OECD countries

	GDP Growth (g)	GDP per capita growth (y)	US patents per capita at t=1 (PT)	US patents per capita growth (pt)	GDP per capita at t=1 (Y)
1890-1913					
g	1.00	0.60*	0.60*	-0.22	-0.18
y		1.00	0.20	0.05	-0.66**
PT			1.00	-0.61*	0.22
pt				1.00	-.67**
Y					1.00
1913-1929					
g	1.00	0.76**	-0.12	0.66**	-0.41
y		1.00	-1.21	0.67**	-0.62*
PT			1.00	-0.55*	0.38
pt				1.00	-0.43
Y					1.00
1929-1950					
g	1.00	0.82**	0.31	0.66**	0.37
y		1.00	0.41	0.58*	0.40
PT			1.00	0.22	0.56*
pt				1.00	0.67**
Y					1.00
1950-1970					
g	1.00	0.75**	0.38	0.89**	-0.76**
y		1.00	0.40	0.71*	-0.76*
PT			1.00	-0.48	0.63*
pt				1.00	-0.84*
Y					1.00
1970-1977					
g	1.00	0.91**	-0.67**	0.29	-0.47
y		1.00	-0.60*	0.16	-0.48
PT			1.00	-0.28	0.66**
pt				1.00	-0.16
Y					1.00

* Significance at 5% level
** Significance at 1% level
Source: Pavitt and Soete (1981)

Table 3.6: Correlation coefficient between Innovative Activity and Output, 1970-2006, 21 OECD countries

	GDP growth (g) 1	GDP per capita growth (y) 2	US patents per capita at t=1 (PT) 3	US patents per capita growth (pt) 4	GDP per capita at t=1 (Y) 5
1970-1977					
g	1.00	0.88**	-0.60**	0.37	-0.87**
y		1.00	-0.49	0.18	-0.70**
PT			1.00	-0.21	0.73**
pt				1.00	-0.14
Y					1.00
1977-1984					
g	1.00	0.88**	-0.36	0.78**	-0.76**
y		1.00	-0.25	0.82**	-0.54*
PT			1.00	-0.26	0.64**
pt				1.00	-0.63**
Y					1.00
1984-1991					
g	1.00	0.96**	-0.15	0.94**	0.94**
y		1.00	-0.13	0.89**	-0.49*
PT			1.00	-0.24	0.61**
pt				1.00	-0.58**
Y					1.00
1991-1998					
g	1.00	0.96**	-0.48*	0.37	-0.34
y		1.00	-0.46*	0.30	-0.25
PT			1.00	-0.27	0.63**
pt				1.00	-0.39
Y					1.00
1998-2006					
g	1.00	0.92**	-0.44*	0.67**	-0.33
y		1.00	-0.36	0.64**	-0.39

PT		1.00	-0.23	0.60**
pt			1.00	-0.12
Y				1.00

* Significance at 5% level
** Significance at 1% level
Source: Own elaborations on data from OECD and USPTO for a sample of 21 OECD countries

A necessary detour: "Globalization" of what?

Let us briefly go through a few domains in which an often anecdotal literature identifies the forces of "globalization". For much more detailed analyses that we largely share, cf. Eatwell (1996); Stiglitz (2002); Meier, Stiglitz and Stern (2000); Kleinknecht and ter Wengel (1998). Bairoch, P. and Kozul-Wright, R. (1996); see also Bowles (2002) and the discussion in Berger and Dore (1996) and Hollingsworth and Boyer (1997). "Globalization" is often defined as a process of integration. This generic definition stresses the multidimensional nature of this phenomenon.

There are at least six relevant dimensions or forces that drive this integration process. The primary force is seen in the development of international trade i.e. the integration process of the commodity markets. Globalization is not only related to the trade of final goods, but also affects the markets for inputs. Thus, the integration of labor markets and financial markets are two other fundamental dimensions. Relatedly, an increased mobility of inputs also results in new productive structures, changes in technology specializations and in institutional arrangements that are required for a country to achieve a successful development. Hence, we present here some of recent evidence on the above dimensions.

International trade

A "globalizing" process of international trade did indeed take place since World War II at quite rapid rates. However, in order to put things into perspective, remember that the ratio of

international trade (exports and imports) over GDP of many countries overtook that of 1913 only around the late 70s/early 80s (see Table 3.7 for the evidence on some major developed countries).

Table 3.7: Exports and imports of goods as a percentage of GNP (current prices)

	1913	1950	1973	1995	2007
France	30.9	21.4	29.2	44.3	54.8
Germany	36.1	20.1	35.3	47.8	85.9
UK	47.2	37.1	37.6	57.1	55.3
Netherlands	60.0	70.9	74.8	111.4	140.2
US	11.2	6.9	10.8	23.2	28.9
Japan	30.1	16.4	18.2	16.9	33.6

Source: Kleinknecht and ter Wengel (1998). Own elaborations for the last two years using data from IMF (International Financial Statistics, June 2008).

These results are consistent with the argument of Findlay and O'Rourke (2003): tariff barriers were low at the beginning of the century, increased during the inter-war period and followed a declining path after 1950. Currently, even if tariff barriers are lower than in 1913, there are important exceptions such as Britain, China and India. The authors also stress that there is a consensus on the fact that non-tariff barriers have increased. Moreover, note that the institutional and tariff impediments to "globalization" have remained the highest in activities in which developing countries are often more competitive such as agricultural products, textile, etc. (see also the evidence in Rodrik (2002c)).

Finally, one observes the persistence of striking international price differentials even in tradable, low-trade-barriers, commodities (cf. the discussions in Rodrik (2002a) and Bradford (2003)). Notice that if we observe an increase in the levels of imports and exports, we can not use it as evidence for a process of globalization, simply because the increase could be the result of some other process. But if globalization was indeed the force behind this increase we would

necessarily also observe a reduction in the price gap among different countries. Instead we still observe significant international price differentials.

Production by multinational companies

There is some evidence that multinational companies have somewhat increased production activities outside the home country. A strong trend of the last 10 years has been the increasing outsourcing of activities by manufacturing firms in developed economies. The very properties of ICT technologies have enabled the dislocation of non-core activities and services to other regions of the world (cf. Miozzo and Soete (2001)). Within this trend, a number of countries have been able to reap the benefits of attracting foreign firms to their sites or simply directly exporting services. In fact, developing economies are playing an increasingly large role in ICT-enabled services, with success stories including Singapore for financial services and India for software. As discussed by Cantwell and Janne (1999), the recent emergence of more global chains of production has made it more important for firms to take strategic decisions not only on which activities to outsource abroad but also on which countries to select as host countries. In this respect the availability of cheap labor is attractive for foreign firms only if it is accompanied by good local infrastructures, high quality labor and, also, tax advantages.

However note that:

1. multi-nationalization of production has mainly been an intra-OECD phenomenon, with limited impact, if any, upon developing and ex-communist countries (cf. Kleinknecht and ter Wengel (1998), Archibugi and Iammarino (2002));

2. at least with respect to OECD, country specific patterns of specialization continue to be rather persistent and path-dependent (cf. Meliciani (2001) and Scarpetta, Bassanini, Pilat e Schreyer (2000));
3. when they one observes significant ruptures in such patterns of specialization, such as in a few developing countries, they seem to be mostly the outcome of major macroeconomic and institutional shocks (cf. many Latin American countries) with a highly controversial impact upon production and technological capabilities (see also below, section 3.4).

Labor markets

Not by any far cry, have labor markets "globalized", with the partial exception of the top tail of the skills distribution (i.e. engineers, scientists, managers, etc.) together with "new economy gurus" of various sorts, actors and football players…[4] The high-tech labor force deserves however a special mention. Lazonick (2007) discusses the "off-shoring" phenomenon: in the first half of the 2000s US-based companies started to transfer large amounts of ICT labor force to locations abroad, primarily India, China and East Asian countries including Korea and Malaysia. Off-shoring is not a new phenomenon, as it happened in a similar way for the semiconductor industry already in the 1960s, with Mexico as the prime location then.

Table 3.8: Mean years of schooling

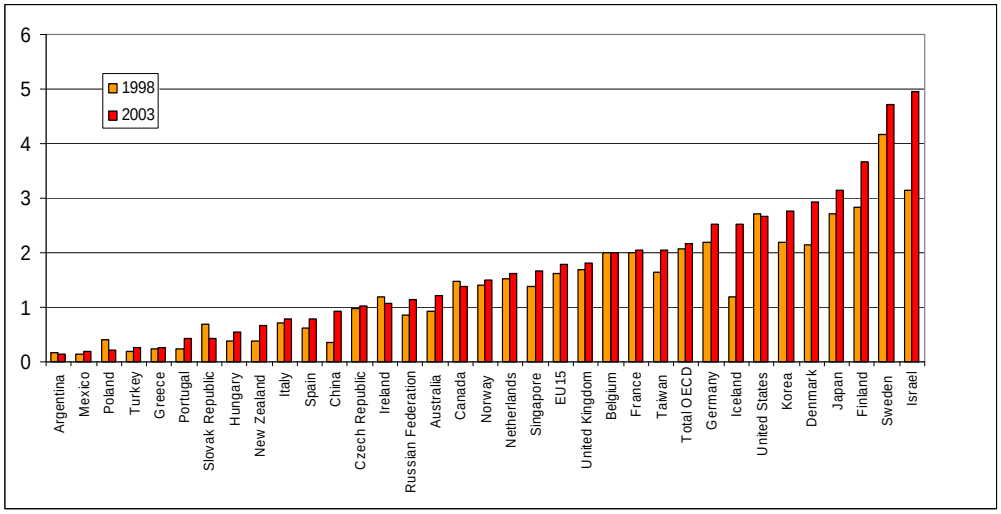
		1970	1980	1990	2000
OECD	Australia	10.2	10.3	10.4	10.9
	Austria	7.4	7.3	7.8	8.4
	Belgium	8.8	8.2	8.9	9.3
	Canada	9.1	10.3	11.0	11.6
	Denmark	8.8	9.0	9.6	9.7
	Finland	6.1	7.2	9.4	10.0
	France	5.7	6.7	7.0	7.9
	Germany			9.9	10.2
	Ireland	6.8	7.5	8.8	9.4
	Italy	5.5	5.9	6.5	7.2
	Japan	7.5	8.5	9.0	9.5
	Netherlands	7.8	8.2	8.8	9.4
	New Zealand	9.7	11.5	11.3	11.7
	Norway	7.2	8.2	11.6	11.9
	Portugal	2.6	3.8	4.9	5.9
	Spain	4.8	6.0	6.4	7.3
	Sweden	8.0	9.7	9.5	11.4
	Switzerland	8.5	10.4	10.1	10.5
	UK	7.7	8.3	8.8	9.4
	US	9.5	11.9	11.7	12.0
NICs	Israel	8.1	9.4	9.4	9.6
	Singapore	5.1	5.5	6.0	7.1
	South Korea	4.9	7.9	9.9	10.8
	Hong Kong	6.3	8.0	9.2	9.4
Latin America	Argentina	6.2	7.0	8.1	8.8
	Brazil	3.3	3.1	4.0	4.9
	Chile	5.7	6.4	7.0	7.6
	Mexico	3.7	4.8	6.7	7.2
	Venezuela	3.2	5.5	5.0	6.6
	India	2.3	3.3	4.1	5.1
	China		4.8	5.9	6.4
World	Mean	4.2	4.9	5.8	6.4
	Coeff. of variation	1.6	1.8	2.0	2.3

Source: Own elaborations on data from UN (2001).

The claim of Lazonick is that off-shoring should be understood as complementary to the movements of large numbers of highly educated individuals from East Asia to the US. For successful Asian countries, some of the brain drain is in fact mitigated as soon as living standards in the home countries rise and indigenous companies emerge. For instance, while Korea can count on successful home-based companies, Malaysia is still strongly dependent on the investment decisions of multinationals. Ultimately the results of the globalization of high-tech labor force depend on "a triad of investment strategies of multinational companies engaged in foreign direct investment, national governments that construct indigenous science and technology infrastructures, and indigenous companies that build on the investment strategies of foreign companies and domestic governments to become world-class competitors in their own right" (*op. cit.*, p. 63).

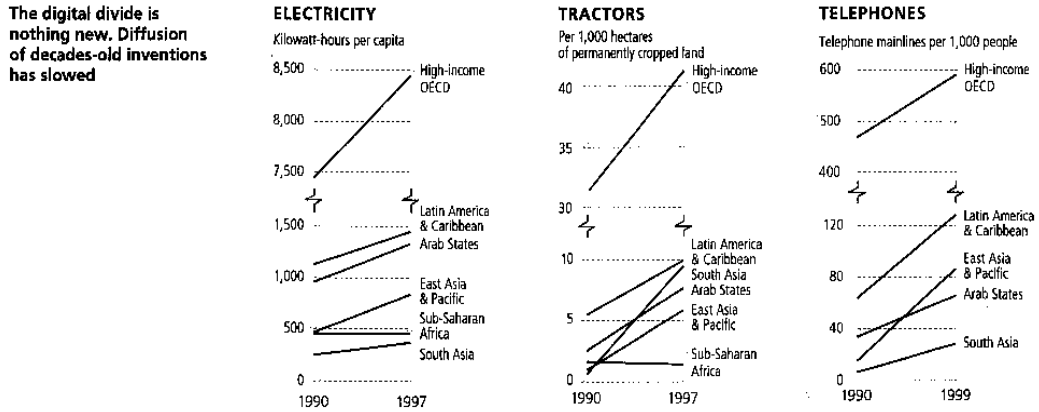
While ICT and high tech labor force is an importance case, one should not forget that for all other jobs national labor markets remain persistently national. At the same time, high and persistent asymmetries in the skills in the population remain the rule: cf. Table 3.8 for evidence of cross-country differences in educational attainments.

Figure 3.2: Intensity of firm level R&D



Source: own elaborations on data from Main Science and Technology Indicators, OECD (2005b).

Figure 3.3: Diffusion of ``old" technologies



Source: United Nations, Human Development Report (2001).

Patterns of generation and diffusion of innovations

One has already mentioned the continuing concentration of innovative activities - notwithstanding remarkable new entrants such as Finland, Korea, Taiwan and to a lower extent Brazil, China and India.

Not surprisingly, such patterns in innovative outputs are matched by persistent international differences in the share of resources devoted to formal technological learning (also revealed by privately financed R&D). So, while Korea has overtaken quite a while ago "developed " countries like Italy, most LDCs continue to display negligible levels of private investments in R&D (cf. 3.2).

Evidence on the number of researchers (Table 3.9) also points to large gaps across countries worldwide, and even within the EU.

Certainly, ICT technologies have determined easier diffusion of information. However, there is hardly any evidence of a generalized acceleration in the rates of adoption of both "new" (e.g. ICT-related) and "old" technologies (from telephones to tractors). Let us begin with the latter. Even in this case there is hardly any evidence of *generalized* patterns of convergence in their use at world level: see Figure 3.3.

As for new technologies, diffusion of the new ICT technologies is occurring in highly asymmetric fashions across countries. This applies to OECD countries and, even more so, to the universe of countries in the world economy. Most of the data available refer to developed countries. But, if gaps are found for those economies, even larger gaps are to be expected for developing ones.

Table 3.9: Number of researchers (per thousand labor force).

	1991	1994	1997	2000	2003	2004
EU15	4.4	4.7	5	5.5	5.9	
Finland	5.5	6.4	10.6	13.4	15.9	
France	5.2	5.9	6	6.5	7.1	
Germany	6.1	5.9	5.9	6.5	6.8	
Ireland	3.8	3.7	4.6	4.9	5.4	
Italy	3.1	3.3	2.8	2.8	3	
Sweden	5.8	7.2	8.4	9.7	10.6	
UK	4.4	4.8	5.2			
US	7.6	7.7	8.4	9	9.1	
Japan	7.5	8.1	9.2	9.6	10.1	
Argentina			1.8	1.8	1.8	1.9
Brazil		0.8		0.8	0.9	0.9
Chile	0.9	1.0	1.0	1.1	1.9	2.0
Mexico		0.5	0.6	0.6	0.8	0.9
Venezuela				0.5	0.5	0.6
Singapore		3.9	5.2	7.6	9.3	
Taiwan			5	5.7	6.7	
South Korea			4.7	4.9	6.6	
China	0.7	0.8	0.8	1	1.1	

Source: Own elaborations on Main Science and Technology Indicators, OECD (2005b). Data for Latin America are from Ricyt (2000).

It is useful to start by distinguishing the relative impact on production and consumption. As for production, there has been an increasing investment in ICT capital for the last 30 years and rising factory automation, all the way from mechanical engineering to continuous cycle processes. At the same time, the evidence reinforces the view – discussed above – that we are still in an initial phase of the diffusion of ICT technologies, certainly with a consistent unexpressed potential. And, again, this applies even more so to developing countries. So, even in the United States ICT investment represents less than 30% of total investment and the share reduces considerably for European countries (see Daveri (2002)). Relatedly, the degree of automation in production has greatly increased, but one is still very far from saturating levels (see the evidence reported in Castaldi et al (2004)).

A complementary but different picture comes out from data on expenditure for Information Technology which can be taken as a proxy for the overall automation of the economy. The percentages remain quite small in size (Table 3.10). The evidence indicates that Japan and Europe lag behind the US in terms of total automation (as proxied by the level of ICT investment), while on the contrary the US lag behind in terms of factory automation (the same circumstantial evidence was already pointed out long ago in Arcangeli, Dosi and Moggi (1991), see also Freeman (2001) for a discussion of the US national innovation system).

As for consumption, the evidence again points to a diffusion of new technologies that is highly uneven across countries, even within the OECD. Table 3.11 reports on the strength of the IT infrastructure in a sample of countries. The ranking of countries now changes. US is far ahead in the `informatization' of its society and the other developed countries follow at considerable distance (the only relevant exception comes from mobile phones). Note the impressive international differences in the diffusion of ICT technologies: compare for example Finland with

Poland or East Asia with Latin America. Interestingly, there is also evidence of a 'digital divide' within the United States (Greenstein and Prince (2007)), with non-urban areas lagging behind in terms of high-speed Internet connection as the better alternative to low-speed/dial-up connection.

Table 3.10: IT expenditure (Information Technology, excluding Communication), as a percentage of GDP

Country	1992	1996	2001	2006
US	4.45	4.93	5.30	3.3
Japan	3.83	3.60	4.00	3.4
EU15	3.03	3.17	4.17	2.7
Sweden	4.37	4.73	6.77	3.8
UK	4.43	4.9	5.62	3.5
Netherlands	3.96	3.84	5.19	3.3
Denmark	3.94	4.1	4.99	3.2
France	3.59	3.74	4.75	3.1
Belgium	3.38	3.34	4.48	2.8
Finland	2.93	3.36	4.38	3.2
Germany	2.94	2.96	4.22	2.9
Austria	2.73	2.8	3.78	2.8
Norway	3.24	3.26	3.66	2.4
Italy	1.8	1.78	2.48	1.7
Ireland	2.35	2.18	2.25	1.5
Spain	1.62	1.56	1.94	1.4

Portugal	1.24	1.48	1.93	1.8
Greece	0.71	0.90	1.20	1.2

Source: Elaborations of Eurostat data.

Table 3.11: Indexes of ICT diffusion, per 100 population

		Telephone lines and cellular subscribers			Internet users			Personal computers		
		1990	**1998**	**2004**	**1990**	**1998**	**2004**	**1990**	**1998**	**2004**
OECD	Austria	42.9	78.9	143.6	0.1	15.4	47.5	6.5	23.8	57.6
	Australia	46.7	77.2	141.3	0.6	22.4	65.3	15.0	36.8	68.9
	Belgium	39.7	66.7	133.4	0.0	7.8	40.2	8.8	21.5	34.7
	Canada	58.7	84.2	111.0	0.4	25.6	62.3	10.7	32.1	69.8
	Denmark	59.6	102.4	160.0	0.1	22.6	50.4	11.5	37.7	65.5
	Finland	58.6	110.2	141.0	0.21	25.4	51.4	10.0	34.9	48.2
	France	50.0	77.6	129.8	0.1	6.3	39.3	7.1	23.2	48.7
	Germany	44.5	73.7	152.6	0.1	9.9	42.7	9.0	27.9	*48.5*
	Ireland	28.8	69.6	143.3	0.0	8.1	29.6	8.6	27.3	49.7
	Italy	39.2	81.0	152.9	0.0	4.5	46.8	3.6	13.3	31.3
	Japan	44.8	86.8	118.2	0.0	13.4	62.2	6.0	23.7	54.2
	Netherlands	47.0	80.5	139.7	0.3	22.2	61.6	9.4	32.4	68.5
	Norway	54.8	113.4	150.9	0.7	36.0	39.0	12.1	40.5	57.8
	Spain	31.7	57.7	131.0	0.0	4.4	35.1	2.8	10.9	25.4
	Sweden	73.5	118.6	180.0	0.6	33.4	75.5	10.5	39.5	76.1
	UK	46.0	80.5	158.5	0.1	13.5	47.0	10.8	26.8	60.0
	US	56.9	90.7	122.7	0.8	30.8	63.0	21.8	45.2	76.2
	Russian Fed.	13.99	20.36	79.1	0	0.81	12.9	0.34	3.46	13.2
	Hungary	9.62	44.09	121.9	0	3.92	26.7	0.96	6.48	14.6
	Poland	8.64	27.74	*76.96*	0	4.08	23.4	0.79	4.91	19.1
Latin America	Argentina	9.3	28.1	58.1	0.0	0.9	16.1	0.7	5.5	*8.2*
	Brazil	6.5	16.5	59.8	0.0	1.5	12.0	0.3	3.0	10.7
	Chile	6.7	27.1	83.6	0.0	1.7	27.9	0.9	6.3	13.9
	Colombia	6.9	20.0	40.1	0.0	1.1	8.5		3.2	5.5
	Mexico	6.6	13.9	53.9	0.0	1.3	13.4	0.8	3.7	10.7

	Peru	2.6	9.3	22.1	0.0	1.2	11.6		3.0	9.7
	Venezuela	7.7	19.8	45.0	0.0	1.4	8.4	1.0	3.9	8.2
NICs	Israel	34.6	82.8	149.0	0.1	10.0	21.8	6.3	20.1	73.4
	Hong Kong	47.5	105.5	173.2	0.0	14.5	50.3	4.7	26.0	60.5
	Singapore	36.3	73.2	132.7	0.0	19.1	57.9	6.6	37.0	*62.2*
	Korea	30.8	75.1	131.4	0.0	6.8	65.7	3.7	18.2	54.5
	India	0.6	2.3	8.4	0.0	0.1	3.2	0.0	0.3	1.2
	China	0.6	8.9	49.7	0.0	0.2	7.2	0.0	0.9	4.1
World	Average	14.9	28.2	*46.7*	0.0	3.7	*13.1*	3.4	8.0	*12.8*
	Coeff Variation	1.2	1.1	*1.0*	4.6	1.9	*1.3*	1.4	1.4	*1.3*

Source: Elaborations on United Nations Millennium indicators. Values in italics refer to 2003.

At the same time communication costs still remain a barrier to ICT use in a number of OECD countries (OECD (2003)).

The most recent evidence about the participation of developing countries to the ICT-based regime shows that East Asian countries such as Korea, Malaysia and Philippines and have the highest share of employment and value added of the ICT sector (both manufacturing and services). Korea and Taiwan have in fact stopped since a couple of decades to be a developing country and has joined the quite exclusive club of innovators. Conversely, most Latin American countries and a few Eastern European ones remain at the bottom of the list (UNCTAD (2006), Chart 1.15).

The OECD Information Technology Outlook 2006 reports the geographical distribution of the top 250 ICT firms. While 116 of these are US firms, followed by 39 Japanese firms, the newcomers are also represented (11 for Taiwan, 6 for Korea, 3 for Hong Kong and for India). Mexico is the only Latin American country included (with 2 top ICT firms).

At the same time, the internationalization of innovative activities by MNCs beyond the home countries has somewhat increased, but one is still talking about rather low proportions. Most studies indicate that patenting by MNCs originating in countries different from that of their own origin is of the order of 10-15% of their total patenting, roughly comparable to their share in the total patenting of the guest countries. Moreover, most of these foreign search activities occur within OECD countries (for discussion of the evidence cf. Patel and Pavitt (1997) and (1999), Cantwell (1992) and Archibugi and Pietrobelli (2003)).

In terms of outsourcing of R&D activities, multinational companies have been much more reluctant to transfer key research labs to developing countries. One of the reasons for firms to decentralize R&D activities is to relocate in the neighborhood of technological centers of excellence in order to enjoy agglomeration economies and spillovers of new knowledge concentrating in that area (Dunning, 1993). But most key geographical technological clusters are still found in the developed world. As shown in Table 3.12, the great majority of R&D foreign affiliates are still located in developed countries and only about 10% in developing countries, of which 8% in Asian countries. Note that, also in this case, the growth figures may be impressive but the levels are not.

There is also evidence that until recently R&D facilities located abroad were mostly responsible for adapting existing products to local needs and tastes, while most fundamental and strategic R&D efforts were maintained in-house in the home countries (Pearce (1989)). 'Support laboratories' (in the definition of Pearce (1999)) are simply responsible for short-term technology transfer and facilitate the assimilation of the technologies for local affiliates. Long term goals may only be achieved if multinationals move from 'support laboratories' to 'locally integrated laboratories' and even 'international independent laboratories'.

Table 3.12: Geographical distribution of R&D foreign affiliates, 2004

Region / economy		Number
Total world		**2584**
Developed countries		**2185**
of which	Western Europe	1387
	United States	552
	Japan	29
Developing countries		**264**
of which	Africa	4
	Latin America and the Caribbean	40
	Asia	216
	South, East and South East Asia	207

Source: UNCTAD, based on the Who Owns Whom database of Dun and Bradstreet.
The data are based on a sample of 2284 majority-owned foreign affiliates identified in the db as engaged in either:

- commercial, physical and educational research (SIC code 8731)
- commercial economics and biological research (SIC code 8732)
- non-commercial research (SIC code 8733)
- testing laboratories (SIC code 8734)

Financial Markets

The liberalization of financial markets has been indeed the most striking phenomenon which has forcefully taken off over the last quarter of a century (cf. Blundell-Wignall and Browne (1991)). Just to provide an order of magnitude, in the 90's one day of foreign exchange trade was typically more than hundred times bigger than world yearly trade (see Eatwell (1996)). Together, barriers to capital movements have hurriedly come down and with that has grown also the volatility of financial flows. The increased volatility of financial flows has also played a major role in a series of financial crises of the last decade including the ones in Mexico in 1994-1995, in East Asia and Russia in 1997-1998 and in Argentina in 2001-2002. These crises have taught us that even if financial integration can bring benefits to the world economy as a whole,

these benefits are distributed unevenly among the participants and developing countries usually bear the highest risks.

Remarkably, even in this case, 'globalization' has gone much faster with respect to 'hot', short-term, speculative finance, with much lower impact — if any — upon long-term activities of investment and production (see the discussion for the Latin American case in Ocampo (2002)). A plausible conjecture is indeed that in a few countries the latter activities have been made more marginal and more 'national'. Kose et al. (2006) argue that financial globalization has brought some benefits, but only after certain "threshold conditions" were met. Such conditions include the quality of institutions, the development of financial markets and the integration of macro-economic policies. In their review of the current evidence, Rodrik and Subramaniam (2008) show how countries growing the most are in fact the ones who have resorted the least to capital inflows stemming from financial globalization.

At the same time, savings and investments have remained stubbornly national. In this respect, one of the major puzzles in international economics is the persistence of the so-called "Feldstein-Horioka puzzle". Feldstein and Horioka (1980) found a high correlation between national saving rates and domestic investment rates for OECD countries in the period 1960-1975. Recent cross-country estimates (Obstfeld and Rogoff (2000)) confirm a high correlation coefficient. Note that the higher is the correlation, the lower is capital mobility

[5]. These results feed the puzzle because under a full integration of capital markets one would expect capital to flow to countries with higher expected returns. In principle savings should be directed to the most productive investments, hence one would predict that capitals from rich developed countries would contribute to investments in poor, but growing, developing countries[6] . As discussed in Eatwell (1996), there are at least three elements that strongly point to an effective lack of integration across national capital markets. First, real rates of return persistently diverge and they diverge in ways which hardly seem to reflect just 'country risks'. Second, net capital flows tend to be directed to developed countries, the US in particular, and not to developing countries. Third, the capital flows directed to developing countries are more volatile and investments are usually in the most liquid financial assets. While foreign direct investment has recently increased for many developing countries, a huge amount of capital flows has instead been of a short-run, speculative nature. For the Latin American case, Stallings and Peres (2000) argue that the boom in FDI flows to Latin American in the 90's is for the most part explained by undertaken investment, which represented around 47% of the accumulated stock of FDI. This process of takeover has resulted in an increase of transnational corporation subsidiaries in the region. Moreover, the overall financial capital in Latin America has become more volatile: short term claims (up to one year) increased from 37% in 1991 to 52% in 1999.

Institutional arrangements

Certainly, the current "globalized" regime of international and political relations is linked with the diffusion, or in many circumstances the imposition at gun point of specific institutional set-ups, drawn from a particular form of Western capitalism—the *laissez-faire* Anglo-Saxon one —, ranging from Stock Exchanges to Intellectual Property Right regimes.[7] However, the piecemeal

diffusion of elements of the "Anglo-Saxon model" is far from producing an international convergence to a unique institutional archetype, notwithstanding the violence through which it is often forced upon the international community by the organizations enforcing the so-called 'Washington consensus' (for thorough discussions see Berger and Dore (1996), Stiglitz (2002), Krugman (1999), Rodrik (2002b)).

Another – equally important and deeply related – level of analysis regards the impact of broad *policy regimes* upon both processes of knowledge accumulation and ultimately growth patterns. It happens that at the level of policy and institutional design Latin America represents a striking *albeit* socially sad "experiment".

Different modes of insertion in the 'global economy'

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. Indeed, for the past quarter of century most Latin American countries have been undergoing a process of structural adjustment which has included, among other policy measures, the elimination of the trade barriers adopted during the 'import substitution' industrialization phase, the privatization of large domestic firms and the de-regulation of the labor and financial markets.

Let us consider in particular the tangled relationships between technology, trade and growth, against the background of the orthodox prescription according to which openness was crucial for industrialization and would have enhanced growth opportunities in developing countries (Krueger (1980, 1997), Srinivasan and Bhagwati (1999)).

Several years into this process, one is in the position to assess the link between trade liberalization and growth and indeed it does not turn out to work the way it had been expected. The poor results of liberalization as a strategy for supporting a prosperous growth path are increasingly emerging. Moreover, the weakness of such a purported link does not merely appear to be a pathology specific to certain countries and/or historical accidents. Rather, it is a widespread pattern that most of the Latin American countries have proved to be unable to achieve the growth rates that prevailed in the 'import substitution' period (Rodriguez and Rodrik (1999), ECLAC (2002), Ocampo (2003)).

The current debate on the effectiveness of liberalization policies is stressing faulty expectations and the the mistakes made by proponents of the Washington Consensus. In fact , as Rodrik (2007) points out, "the countries that did best … were hardly poster children for open markets and laissez-faire economics" (p.2). Countries like China, India and Vietnam, indicated by the World Bank as 'star globalizers' were instead among the most protected countries in the 1990s, while Latin American countries followed all predicaments and performed disappointingly. A simple causal relation between openness and growth does not hold, as standard liberalization policies cannot exert the same effect on all countries. Instead, different countries might benefit or not from globalization depending on individual circumstances largely influenced by specific national institutional arrangements.

Laissez-faire regimes, trade openness and technology gaps in Latin America: a "low growth trap"

One way to determine how policies aimed at trade liberalization and the adoption of an "outward" orientation have influenced growth is to investigate the main tendencies and constraints that characterized the Latin American economies following economic reform (Ocampo (2003)).

Let us start by comparing a few relevant macro-variables referring to different key periods before and after the implementation of reforms. For our purpose here, it is useful to distinguish between:
(i) the 'Import Substitution Golden Age' (IS Golden Age), which includes the years 1950-1973 for all countries in our sample;
(ii) a 'Pre-Trade Reforms' period of shocks and adjustments (Pre-Reforms);
(iii) a 'Post-Trade Reforms' regime (Post-Reforms).

Most analyses only investigate the last two periods and basically refer to the timing of the 'Before reforms' and 'After reforms' periods used in Stallings and Peres (2000) and Ramos (1997). The 'Before reforms' period is defined as a quite long set of years which in fact covers a rather uncertain phase including also the 'lost decade' of the 80s. For some countries this period does *not* entail trade liberalization, but most often does present rather wild restrictive macro-policy shocks. We choose to include in our analysis also the IS Golden Age. Hence, we are able to detect even more dramatically the impact of liberalization reforms upon Latin American countries.

As the region opened up, it did witness a large increase in both exports and imports (see Table 3.13). Exports rose after economic reforms were implemented, but import requirements increased even more, thus *tightening further* the trade balance constraint on GDP growth. Overall, empirical evidence shows that the average growth rate of GDP decreased dramatically after the liberalization reforms. Together the trade deficit widened. Indeed, both import and export elasticities appear significantly higher in the last period, but the elasticity of imports remains generally greater than the elasticity of exports. In that, the role played by the balance of payments as a determinant of domestic economic performance emerged clearly in the post-reform period (see

also Moreno-Brid (1999), Perez and Moreno-Brid (1999), Frenkel and Gonzalez (1999), Holland et al. (2001)).

Remember that, in order to balance its foreign accounts, the growth of any one country is constrained , at least in the long term, by the dynamics of its current-account balances ,which in turn are basically determined by the dynamics of exports and imports plus the net remittances from labor and capital employed abroad by country and tourism . As a qualification , it is possible to think of a country which grows *less* than the constraint because of a systematic outflow of financial resources on the *capital* account. It is harder to think of a country which grows more than the constraint despite *negative current and capital account*. The only exception *so far* are obviously the United States , as long as the rest of the world is ready to accept to finance American growth in exchange of green i-owe-you papers with increasingly dubious value.

Back to our central point. The export-led orientation in many Latin American countries came together with a sharp increase in import elasticities which was less than compensated by some acceleration in the catch-up in relative productivity[7]. A vicious growth pattern came out to be reinforced: for a discussion of how one can formally model vicious and virtuous growth patterns, we refer the reader to the analysis in Castaldi et al. (2004).

Moreover, if economic and trade performance of most countries in the region appear to deteriorate after liberalization reforms as compared to the uncertain phase of the 'Pre-Reforms' period, the evidence is *a fortiori* stronger when the comparison is carried out with respect to the Golden Age.

All this contrasts sharply with the experience of some Asian economies, such as Korea. In this case, it is interesting to note that the productivity gap shrank and, at the same time, the

elasticity of demand for imports decreased (see Table 3.14). Thus, a virtuous growth pattern was established.

In addition to aggregate growth performance and trade balance changes it is useful to look at the specialization patterns of Latin American countries and at how these have changed after the liberalization reforms. Table 3.15 provides a synthetic appreciation of the 'dynamic quality' of export specialization of various economic regions. Japan and the Asian Tigers appear to have been the most successful in reaping the benefits from fast growing markets, while Latin American countries exports have been mainly in commodities characterized by low income elasticity with respect to international demand.

Table 3.13: Indicators of growth and trade balance performance for three different periods

Country	Period	Years	Growth rate	Import elasticity	Export elasticity	Change in productivity gap
Argentina	IS Golden Age	1950-1973	3.49	0.42	0.71	
	Pre-Reform	1974-1990	0.34	-3.10	14.29	0.84
	Post-Reform	1991-2003	1.81	2.66	3.81	0.91
Brazil	IS Golden Age	1950-1973	7.20	0.80	0.78	
	Pre-Reform	1974-1989	4.07	-0.27	1.98	0.55
	Post-Reform	1990-2003	1.83	3.74	3.64	0.76
Chile	IS Golden Age	1950-1973	3.64	1.45	0.60	
	Pre-Reform	1974-1984	1.63	-0.38	3.81	1.60
	Post-Reform	1985-2003	5.34	2.07	1.70	0.65
Colombia	IS Golden Age	1950-1973	5.20	0.57	0.88	
	Pre-Reform	1974-1989	4.12	0.82	1.28	0.58
	Post-Reform	1990-2003	2.71	2.35	1.64	1.03
Mexico	IS Golden Age	1950-1973	6.56	0.66	0.69	
	Pre-Reform	1974-1985	4.58	0.58	2.37	0.67
	Post-Reform	1986-2003	2.88	4.42	3.23	0.68
Peru	IS Golden Age	1950-1973	5.12	1.19	0.99	
	Pre-Reform	1974-1989	0.75	-5.46	2.85	-0.92
	Post-Reform	1990-2003	3.74	1.87	2.19	0.78

Uruguay	IS Golden Age	1950-1973	1.55	-0.12	-0.25	
	Pre-Reform	1974-1977	3.67	-0.14	4.23	1.33
	Post-Reform	1978-2003	1.03	3.44	3.02	0.77
Latin America Weighted Average	IS Golden Age	1950-1973	3.04	0.58	0.74	
	Pre-Reform	1974-1989	3.12	0.58	2.42	0.43
	Post-Reform	1990-2003	2.45	3.64	3.31	0.74

The table reports average growth rates of income, elasticities of imports and exports. The change in productivity gap is the percentage change in productivity for the country relative to the same change in the international technological frontier (the US). Thus a value higher than 1 stands for catching-up.
Source: Own elaborations on ECLAC statistics and Bureau of Economic Analysis (US Department of Commerce).

Table 3.14: Indicators of growth and trade balance performance for three Asian Tigers before and after the Asian financial crisis different periods

			Growth rate	Import Elasticity	Export Elasticity	Change in productivity
Hong Kong	Early Industrialization	1960-75	8.7	0.88	0.99	0.89
	Pre-crisis	1976-97	6.8	1.95	1.81	3.04
	Post-crisis	1999-06	5.5	1.70	1.87	2.39
Korea	Early Industrialization	1960-75	8.0	2.10	3.42	2.49
	Pre-crisis	1976-97	7.7	1.56	1.62	3.94
	Post-crisis	1999-06	5.2	1.98	2.33	1.78
Taiwan	Pre-crisis	1977-97	10.6	1.43	1.41	6.45
	Post-crisis	1999-06	4.0	1.81	2.11	1.62

Source: Own elaborations on data from World Development Indicators, Taiwan Statistical Office and GGDC.

Table 3.15: Dynamic efficiency of the Regional Patterns of Specializations: ratio of market shares in OECD imports in 'dynamic' vs 'declining' commodities, 1961-2002

	Period							
	1963-1971		1971-1989		1979-1989		1989-2004	
USA	1.22	1.22	1.63	1.39	1.72	1.60	1.01	0.88
Japan	2.45	3.52	1.64	3.15	3.40	3.34	2.43	1.87
EU (12 first members)	1.52	1.23	1.55	1.21	1.98	1.40	0.92	0.91
Central and Latin America	0.38	0.22	0.21	0.39	0.28	0.36	0.70	0.80
Asian Tigers	1.48	2.29	2.38	2.58	3.40	3.08	1.27	1.90

Note: 'Dynamic' commodities are those which have undergone above average growth of OECD trade (imports) over the considered period.
Source: Elaborations by O. Mandeng on the CAN databank, ECLAC, Santiago de Chile, and by the authors.

Geographically, two separate patterns appear to have emerged for Mexico and the Central American countries, on the one hand, and South America, on the other. The South American countries have intensified their specialization in natural resources and standardized commodities. These are now highly capital-intensive industries with low domestic value added. Firms producing for local markets - which are labor-intensive and engineering-intensive - have suffered most from trade liberalization and market deregulation initiatives. Conversely, countries such as Mexico and the Central American nations have greatly globalized their manufacturing and assembly activities based on cheap labor. The structural features of the specialization pattern have affected the capacity to achieve equilibrium on the current account (Katz and Stumpo (2001)).

The Chilean experience is an interesting one, which at a first look is in conflict with the thrust of our argument. Indeed, between the mid-1980s and the end of the 1990s, Chile experienced an impressive rate of growth for a country whose export bundle consisted almost exclusively of natural resource-based products and standardized commodities characterized by low income elasticity of demand. However, emerging difficulties in diversifying manufacturing output and in developing local technological and productive linkages (Moguillansky (1999)) suggest that even Chile might find it hard to keep average growth rates comparable with the 'import substitution golden age' (Ocampo (2002)).

Some microeconomic roots of persistent technology gaps: low knowledge content of specialization patterns and forms of new dualism

Let us begin to explore the micro-dynamics of production and technological learning underlying Latin American Countries (for empirical evidence and an analytical formalization, see Cimoli and Katz (2001), and ECLAC (2000, 2002)). So far, we have mostly discussed aggregate patterns

concerning e.g. productivity, export and income growth. However, the transition to *laissez-faire*, free-trade, regimes has also implied profound changes in the sectoral composition of output, in the patterns of technology accumulation and diffusion, and in the 'demography' of firms. It is in the underlying microeconomics that one has to ultimately nest the interpretation of the worsening trade balance in Latin America.

In the first place, the weak link between exports and growth may be understood as the result of a new dualism in the production system and in the pattern of technology accumulation which has emerged as an effect of the liberalization shocks.

There is little doubt that such shocks have increased competitive selection and induced strong modernization pressures. However, the final outcomes in terms of knowledge accumulation are much more blurred. Many production activities have been seriously disrupted by trade liberalization and by the massive inflow of imports, particularly in technology-intensive fields, which have rapidly begun to de-verticalize their production organization technologies, replacing domestically-produced intermediate inputs with cheaper (and sometimes better) imported ones and reorganizing themselves more as assembly-type operations based on a much higher unit import content.

At the same time, the disappearance of many activities along the 'value chain' of production has often broken down local networks of user-producer links and the related processes of knowledge diffusion. The heterogeneity of responses has been quite striking, not only across production sectors, but also across individual firms within narrowly defined industries. Thus, failure and success tend to occur side by side even within the same production activity. The share of "large" firms - either local subsidiaries of transnational corporations or domestically-owned conglomerates - in GDP increased significantly during the adjustment process, while countless

SMEs were forced to exit the market altogether. Only a very small group of "modernized" domestic-owned and export-oriented firms are becoming global in terms of their production orientation and their capacity to acquire and creatively build upon foreign technology in international networks. Note also that even these "modernized" firms are, in fact, characterized by fewer linkages with domestic institutions of higher education and with local research centers and laboratories than in the past.

In terms of specialization patterns, following the trade reforms, many of Latin American economies increased their share of production in a) natural resources and natural resource processing industries (such as pulp and paper, iron and steel, vegetable oil, etc.) and b) maquila industries (that is largely assembly activities in sectors like electronics, television sets and video equipment, etc.)[8]. Conversely, other industries, such as footwear, garments and furniture, and industries that produce engineering- and knowledge-intensive products (capital goods, agricultural machinery, machine tools, pharmaceuticals), have seen their share decline throughout the continent. In fact a fundamental paradox stands out. After trade liberalization Latin America as a whole did *not* witness any adjustment in the specialization profiles toward more labor intensive sectors, but it did- if anything - toward more resource-intensive *and capital-intensive* production structures.

At the same time the share of the *informal sector* in total employment appears to have dramatically increased (up to 46%, according to Cimoli et al. (2006)[9]). In this respect, even the "Import Substitution Golden Age" did not fare particularly well: even in presence of a sustained GDP growth, one is hardly able to absorb within the 'formal' sector a constant share of the labor force attracted to urban areas (Cimoli et al. (2006)). However, the last couple of decades have been particularly disappointing. The end result is a widening *dualism* whereby an increasing share of the

whole economy is composed of activities typically characterized by a low knowledge content and low opportunities for technological and organizational learning.

Another relevant issue is the role played by large domestic firms and subsidiaries of multinational enterprises (MNEs). Subsidiaries of MNEs, in e.g. motor vehicles, other consumer durables, etc., have adopted the technologies developed by their parent companies in industrialized countries. Conversely, a few - too few perhaps – domestic Latin American firms during the 'IS Golden Age' tried to pursue economies of scale and learning procedures which happened to enable them to compete in the international market after the economy was opened up. This involved the adaptation of production and product designs for the domestic market, to begin with, as well as efforts to improve organization and increase production capacity. Examples of such firms include large roups in the chemicals, brewing and glass container sectors, which did not only increase their production capacity to internationally visible levels, but revealingly also carried out earlier R&D activities during the IS phase.

Under brutal policy shocks it happened that the long-term accumulation of local technological capacity has been hampered by the replacement of engineers with machines in the process of re-organizing production. Similarly, entire R&D and project engineering departments have been eliminated as firms have become part of worldwide integrated production systems and R&D and engineering efforts have been transferred to headquarters. The same is observed in the case of public firms providing telecommunications, electricity and transport services, which, after privatization, discontinued their domestic R&D and engineering departments and relied instead on their respective central offices for technology and engineering services. These changes in the organization of production forcefully entail the "destruction" of human capital and domestic technological capabilities and their replacement with "capital embodied" technologies and with

foreign-supplied R&D and engineering services. Some of the skills and technological capabilities made redundant by the new production organization arrangements can and have been successfully transferred to other areas of the economy, e.g. to a newly emerging and rapidly expanding software industry, for example. Others, however, have remained idle.

In the last resort, the emerging patterns of production specialization turn out to be strongly biased against domestic knowledge generation (cf. also the discussion in Cimoli and Katz (2001) and ECLAC (2002)). This process means that, while Latin America does actively participate in the globalization of production, its participation in the "globalized" scientific and technological activities is very limited, as multinational companies transfer only a limited amount of their R&D activities to the region.

To sum up, Latin America's poor growth performance in the wake of liberalization strategies encapsulates a complex set of issues related to the interaction between trade balances, specialization patterns and the process of technological learning. Certainly, the trade liberalization shock has acted upon both exports and imports, inducing a significant increase in both. However, the 'bad' patterns of specialization, biased in favor of commodities characterized by low income elasticities, has meant a relatively tighter foreign balance constraint to growth, less than compensated by some catching-up in relative productivity *vis-à-vis* the international frontier. The end result appears to be a "vicious" pattern of export-led growth. At the same time, the "modern" part of the economy has shrunk, yielding a dual production structure with relatively small dynamic enclaves floating within a sea of relatively stagnant and marginal activities.

Finally, knowledge-intensive industries appear to be losing ground as a proportion of GDP while non-tradable activities, natural resource processing industries and "maquila"-type assembly operations (catering mostly to United States markets) increase their share. The sources of

technological change and productivity growth have also shifted significantly, with a rapidly increasing share of external (foreign) sources emerging at the expense of domestic ones.

Note that all these considerations apply strictly apply to the last quarter of a century and continue to apply also to the most recent years when a few countries –those rich in natural resources - have experience remarkably higher rates of growth due to the rising prices of minerals, fuels and several agricultural commodities. Certainly, everything said concerning technological learning , industrial structures, patterns of specialization continues to hold. The only question marks regards whether a country can sustain a durable growth in per capita income just driven by the export of natural resources notwithstanding persistent gaps in domestic capabilities (even assuming that the terms of trade continue to improve). The historical experience of Arab oil-producing countries suggests a strikingly negative answer. However, one shall come back to the point in the conclusions

Beyond the "Globalization hype": some concluding remarks

In a nutshell, if our interpretation is correct, so-called "globalization" has mainly to do with: a) the international liberalization of capital movements and b) (a rather asymmetric) liberalization of trade flows, while bearing rather controversial effects upon the international patterns of technological learning and the related distribution of growth possibilities among countries. The evidence that we have presented in this chapter points to persistent diversity in levels of incomes, growth rates and technological capabilities, also under (or even partly because of) a 'globalized' international economy. This ought to be the fundamental 'stylized facts'. Relatedly let us conclude by proposing three key considerations.

First, a myth to dispel is that "globalization" — in the sense of higher international integration— comes naturally together with "convergence" or higher uniformity in technological capabilities. As argued at greater length in Pavitt (1999) and (2002), and Dosi, Orsenigo and Sylos

Labini (2003), knowledge as distinct from sheer information, tends to be rather sticky in its transmission, embodied as it often is, in specific people, organizations and local networks.

Second, 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).[10] 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.

Third, 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 induce higher selection upon domestic firms (especially in Latin America), massive mortality of firms does 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 (2005)).

The continuing divergent tendencies across countries and across social group within them, reiterate the secular historical lesson that today, like two centuries ago, there is no 'natural drift' toward the international frontier in technologies and income. On the contrary. However, the quite a few experiences of successful catch-up also tell a story of 'windows of opportunities', which appropriate mixtures of policies and institution-building might help to seize. Indeed a good deal of

the chapters which follow are precisely about the nature of the processes by which such opportunities are seized.

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[1] More detailed discussions by two of the authors are in Dosi, Pavitt and Soete (1990), Cimoli and Dosi (1995), Dosi, Freeman and Fabiani (1994) and Dosi, Orsenigo and Sylos Labini (2003).

[2] Tables 4 and 5 are based on Pavitt and Soete (1981) for the years until 1977. Their original sample included 14 OECD countries. Results for most recent years in Tables 4 and 6 are obtained for an updated sample of 21 OECD countries (Australia, Austria, Belgium, Canada, Denmark, Finland, France, Germany, Hungary, Ireland, Italy, Japan, Korea, Mexico, Netherlands, New Zealand, Norway, Spain, Sweden, Switzerland and United Kingdom). Our elaborations are based on data from OECD (real GDP, population and R&D spending in the business sector) and USPTO (historical series of granted patents).

[3] His sample includes most world economies and covers the years 1960-1982.

[4] For a discussion of the lack of globalization of labor markets and its implications cf. Rodrik (2002a).

[5] It should also be noted that this high correlation between saving and investment is not found at regional level, *within countries* (cf. Obstfeld and Rogoff (1996)), which hints at the specificity of the patterns of capital mobility across different institutional systems.

[6] This argument is also presented in Lucas (1990), which again discusses why capital flows more from rich to rich countries than from rich to poor.

[7] The case of Chile is exceptional, with a significant shrink in the productivity gap in the period 1974-1984 and import elasticities falling. This is at least partly due to cyclical factors since imports shrink in the end years due to the crisis which peaked in 1982.

[8] Another sector which grew, in *some countries*, is the automotive one, but in this case, first, liberalization was no shock on local producers because there were none but mostly subsidiaries of world multinationals, and, second, the latter have been able, when needed, to bargain tariff and trade exceptions.

[9] The distinction between 'formal' and 'informal' sector follows the rather expansive definition provided by ECLAC, trying to capture the traditional activities as opposed to the non-traditional ones (thus, in addition to personal services it includes all commercial and manufacturing activities undertaken in entities with less than 5 workers).

[10] On the point, within a growing literature, see the complementary arguments of Arthur (1994), Dosi, Pavitt and Soete (1990), Krugman (1996), Antonelli (1995), Cimoli (1988).