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Foreign Direct Investment and Innovation Activities in European Union

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Abstract: *Research and Development (R&D) and technical change are both directly related to industrial infrastructure conditions, modernization process, productivity levels, regional and socio-economic growth. Technological change caused by Foreign Direct Investments (FDIs) usually widens the socio-economic gap and divergence between different regions (concentration effect), whereas technological imitation, transfer and diffusion tend to enhance regional convergence and cohesion (diffusion effect). This paper attempts to investigate the relation between FDIs, technical change and regional growth. Additionally, it aims to estimate the impact of technical change generated by FDIs on regional growth, and uses the theory and empirical evidence in an investigation of the implications of FDIs, and research activities at the regional and economic growth.*

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Keywords: *Technical Change, Foreign Direct Investment, Innovation, Diffusion,*

INTRODUCTION

Foreign direct investment (FDI) inflows and outflows to and from OECD countries showed continuing rapid growth last year. Inward investment into OECD countries grew by 35% and reached US dollars (USD) 684 billion, while outflows showed an increase of 22% and amounted to USD 768 billion. Some OECD experienced an unprecedented level of inflows (*e.g.* Japan, Sweden and Germany) and others recorded historically high outflows (*e.g.* Denmark, France and Ireland).

The increase in greenfield investment was significant in 1999, but it was by far exceeded by the growth in mergers and acquisitions (M&A). As in previous years, M&A was the primary vehicle behind the increase in FDI. Last year, Western Europe was the world's leading region for cross-border M&A. The 1990s brought considerable improvements in the investment climate, influenced in part by the recognition of the benefits of FDI.

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The change in attitudes, in turn, led to a removal of direct obstacles to FDI and to an increase in the use of FDI incentives. Continued removal of domestic impediments through deregulation and privatization was also widespread. Deregulation and enhanced competition policy made M&A more viable in the telecommunications, electricity, other public utilities and financial services sectors, while privatization programmes provided opportunities for international investment. The sale of state-owned companies to foreign investors represented a large share of the source of FDI, particularly among new members to the OECD and in some emerging economies.

Foreign direct investment contributed substantially to the transfer of new technologies and consequently to the modernisation and reorientation of the structure of the economies. The main bulk of technology transfer took place either through foreign direct investments (FDIs) (mainly through multinationals MNEs) or through *technological agreements* (for instance, licensing and joint ventures). *Mergers and acquisitions* have played a major role in this direction. Acquisitions have been used by foreign and domestic firms as a tool for strengthening their position in domestic or international markets.

This paper questions the proclaimed crisis and the industry it has spawned, and assesses the implications for policy. To do this, it examines critically the claims of regional disadvantage and examines the factors that influence regional economic and social conditions. This article's section deals with the FDIs trends, and moreover with Research activities. In the following sections, FDI trends and Research Activities are analyzed and used to illustrate the role of regional growth.

In particular, this paper focuses on regional development, one of the critical policy issues which emerged during the 1990s for reasons of social and national development. The term regional development is somewhat amorphous. Its definition varies according to context, although a common thread concerns some kind of economic and social improvement. Such improvement can take the form of more and better quality infrastructure, improved community services, a greater and more diverse volume of production, lower unemployment, growing numbers of jobs, rising average wealth, improved quality of life, and so on. These dimensions are, of course, interconnected in some degree, though not invariably so. Regional development is a difficult policy arena in which all tiers of government have had limited success.

DEFINITIONS AND TRENDS

Efforts in the areas of FDIs and Research Activities have been associated in the economic literature with higher growth rates, increases in exports and trade, gains in productivity, growth in income and output, bigger business profits and lower inflation, international competitiveness. In this section will present and analyze the terminology, classification and the main concepts of Foreign Direct Investment, Research Activities and Innovation.

Innovation is about taking risks and managing changes. It is about economics over and above research, science and technology. Some have defined it as 'profitable change', others as 'economic exploitation of new ideas'. A more business-related definition could be:

> Innovation means harnessing creativity to invent new or improved products, equipment or services which are successful on the market and thus add value to businesses» (Guy de Vaucleroy , European Business Summit, Brussels June 2000).

In short, as Professor Joseph Schumpeter said:

> Innovation is at the root of the evolution of the economic system and its main engine for change and "creative destruction".

There are many aspects of technology transfer to be studied (such as through the direct investment, multinational corporations, joint-ventures and the licensing agreements). This section investigates the transfer of technological inputs through FDIs, MNEs and licensing agreements. Technology transfer has been variously defined. According to the definition provided by the United Nations (UNCTAD), it can be considered as:

> Technology as the essential input to production which can embodied either in capital and in intermediate goods or in the human labour and in manpower or finally in information which is provided through markets.

We can also distinguish between *technology transfer* and *technology capacity* (that is the flow of *knowledge* as against the *stock of knowledge*), and also the *technology of innovation* (which indicates the type of technology that gives to the recipients country's the capacity to establish a new infrastructure or to upgrade obsolete technologies).

Direct investment is a category in which an international investment made by a resident entity in one economy (direct investor) with the objective of establishing a lasting interest in an enterprise (or otherwise the direct investment enterprise) resident in another economy is classified. *Direct investment* involves both the initial transaction between the two entities and all subsequent capital transactions between them and among affiliated enterprises, both incorporated and unincorporated.

OECD recommends that direct investment flows be defined as:

> A foreign direct investor may be an individual, an incorporated or unincorporated public or private enterprise, a government, a group of related individuals, or a group of related incorporated and/or unincorporated enterprises which has a direct investment enterprise – that is, a subsidiary, associate or branch – operating in a country other than the country or countries of residence of the foreign direct investor or investors.

Moreover, following the IMF definition, we can say that:

> Direct investment refers to investment that is made to acquire a stake in an enterprise operating in an economy other than that of the investor, the investor's purpose being to have an effective voice in the management of the enterprise. The foreign entity or group of associate entities that makes the investment is termed the direct investor. The

> unincorporated or incorporated enterprise (a branch or subsidiary, respectively) in which a direct investment is made is referred to as a direct investment enterprise.

According to the OECD definition:

> A foreign direct investor is an individual an incorporated or unincorporated public or private enterprise, a government, a group of related individuals, or a group of related incorporated and/or unincorporated enterprises which has a direct investment enterprise (that is a subsidiary, associated enterprise or branch operating in a country other than the country/ies of residence of the direct investors).

Also, *Direct Investment Enterprises* are defined as:

> Incorporated or unincorporated enterprises in which a single foreign investor either controls ten per-cent or more of the ordinary shares or voting power of an incorporated enterprise (or the equivalent of an unincorporated enterprise) or has an effective voice in the management of the enterprise.

Finally, the OECD definition states that:

> Direct investment flows are defined to include for subsidiary and associated companies: the direct investor's share of the company's reinvested earnings plus the direct investor's net purchases of the company's share and loans plus the net increase in trade and other short-term credits given by the direct investor to the company. For branches this includes the increase in unremitted profits plus the net increase in funds received from the direct investor. Finally, loans on short-term balances from fellow subsidiaries and branches to foreign direct investment enterprises, loans by subsidiaries to their direct investors and loans guaranteed by direct investors and defaulted as well as the value of goods leased by direct investors should be included in direct investment, with an exception only for the bank, deposits, bills and short term loans which should be excluded from direct investments.

A direct investment enterprise may be defined as an incorporated or unincorporated enterprise in which a foreign investor owns 10 per cent or more of the ordinary shares or voting power of an incorporated enterprise or the equivalent of an unincorporated enterprise. The numerical guideline of ownership of 10 per cent of ordinary shares or voting stock determines the existence of a direct investment relationship. Some countries may consider that the existence of elements of a direct investment relationship may be indicated by a combination of factors such as:

- representation on the board of directors;
- participation in policy-making processes;
- material inter-company transactions;
- interchange of managerial personnel;
- provision of technical information;
- provision of long-term loans at lower than existing market rates.

The concept of Scientific and Technological Activities has been developed by OECD and UNESCO and EUROSTAT. According to "International Standardization of Statistics on Science and Technology", we can consider as scientific and technological activities:

> The systematic activities which are closely concerned with the generation, advancement, dissemination and application of scientific and technical knowledge in all fields of scientific and technology. These include activities on R&D, scientific and technical education and training and scientific and technological services.

Furthermore, we can distinguish the Research and Development (R&D) activities from Scientific and Technical Education and Training, and also from Scientific and Technological Services, as follows:

> Scientific and Technical Education and Training activities comprising specialized non-university higher education and training, higher education and training leading to a university degree, post-graduate and further training, and organized lifelong training for scientists and engineers,

while

> Scientific and Technological Services comprise scientific and technological activities of libraries, museums, data collection on socio-economic phenomena, testing, standardization and quality control and patent and license activities by public bodies.

There is a huge literature studying the effects of innovation activities, however, only a small part of these examines the effects to a regional level. One of the major problems for the measurement of innovation activities is the availability of disaggregated data and the lack of information in a regional level (in particular, for the less advanced technological countries).

According to the definition provided by UNCTAD:

> Technology is considered as the essential input to production which can embodied either in capital and in intermediate goods or in the human labour and in manpower or finally in information which is provided through markets» (United Nations, 1983).

We can distinguish between *technology transfer* and *technology capacity* (that is the flow of *knowledge* as against the *stock of knowledge*), and also the *technology of innovation* (which indicates the type of technology that gives to the recipients country's the capacity to establish a new infrastructure or to upgrade obsolete technologies).

The major sources of these data are coming OECD, United Nations and European Union and local authorities. Since 1965, the statistics divisions of OECD and UNESCO have organized the systematic collection, publication and standardization of research and technological data. We can collect and present data both for Business, Government and Private non-profit sectors. Business Sector including all firms, private and non-private institutions, organizations whose primary activity is the production of goods and services for sale to the general public at price intended to cover at least the cost of production; public enterprises are also included in the

Business Enterprise sector. Government sector includes all departments, offices and other bodies which normally do not sell to the community those services which cannot otherwise be conveniently and economically provided. Private non-profit sector includes private or semi-public organizations and also individuals and households, however be excluded all enterprises which serve government or those which financed and controlled by government and those offering higher education services or controlled by institutes of higher education. Higher education is comprised of all universities, colleges of technology and other institutes of post-secondary education. Finally, data from abroad includes all institutions and individuals located outside the political frontiers of a country, and all international organizations (except business enterprise) including facilities and operations within the frontiers of a country.

Apart form the OECD and the U.N. research departments, there is another committee (the *Scientific and Technical Research Committee*) which deals with research and innovation statistics. The research and scientific indicators not only provide a view of the innovation and research structure of a given country, but also indicate its *technological strength and capacity* relative to others. The various research and technological indicators attempt to explain *technological relationships* at a specific point of time or for a whole period. The aim is to measure the nature, the capacity and the efficiency of scientific and technological activities both at a national level and at a sectoral level. Technological indicators related to *output measures* are more meaningful than those related to *input measures* (such as the number of scientists and engineers which are involved in research activities or the number of research institutions), since the later say little about the achieved research.

The use of research and technological data implied a lot of problems with the collection and measurement. The problems of data quality and comparability are characteristic for the whole range of data on dynamic socio-economic activities. However, most of the research and technological indicators capture technological investment in small industries and in small firms only imperfectly. Usually only, the manufacturing firms with more than 10,000 employees have established some research and technological laboratories, while industrial units with less than 1,000 employees usually do not have any particular research activities. Finally, the research and technological statistics concentrate mostly on the manufacturing sectors, while usually neglecting some service activities.

Table 1 illustrates the main figures of FDI for selected and group of countries. Developed countries attracted $ 636 billion in FDI flows, nearly three quarters of the world's total. The United States and the United Kingdom were the leaders as both investor and recipients with $ 199 billion, the United Kingdom became the largest outward investor in 1999. The driving force behind this trend was transatlantic M&A. Compared with last year, the United States strengthened its net capital importing position, while the United Kingdom's balance shows increasingly high net outflows. Inflows into the United States came mainly from Europe. The most important

investors were the United Kingdom, Germany and the Netherlands. The history of FDI is relatively short for the formerly planned-economies, which opened up to capital inflows only at the end of the eighties and beginning of the nineties. Absolute values of FDI inflows have been growing during the last decade. However, compared with its contribution to world GDP or world imports, the region's share in total world FDI stock is still relatively low. FDI performance can be differentiated by two groups of countries. As for FDI flows per capita, Estonia, Latvia and Slovenia can be added to the best performers with a more than USD 1500 per capita inflow. Countries in the second group had negligible inflows of FDI, with the notable exceptions of Russia, Kazakhstan and Azerbaijan.

Table 1
Geographical Distribution from the Flows of Foreign Direct Investment

	1980			*1990*			*2000*		
	Bill. $ US	*% of world total market*	*% of GDP*	*Bill. $ US*	*% of world total market*	*% of GDP*	*Bill. $ US*	*% of world total market*	*% of GDP*
Developed countries	375.0	60.9	4.7	1398.0	74.0	8.4	4210.3	66.7	17.2
West Europe	200.8	32.6	5.5	786.6	41.6	11.1	2501.5	39.6	30.1
European Union	185.7	30.2	5.3	739.6	39.2	11.0	2376.2	37.6	30.1
Austria	3.2	0.5	4.0	9.9	0.5	6.2	27.4	0.4	14.4
Belgium	7.3	1.2	5,9	58.4	3.1	28.3	372.1	5.9	151.9
Denmark	4.2	0.7	6.3	9.2	0.5	6.9	52.2	0.8	32.0
Finland	0.5	0.1	1.1	5.1	0.3	3.8	23.0	0.4	19.0
France	22.9	3.7	3.4	100.0	5.3	8.4	266.7	4.2	20.5
Germany	36.6	5.9	4.0	119.6	6.3	7.3	461.0	7.3	24.6
Greece	4.5	0.7	11.3	14.0	0.7	16.9	23.1	0.4	20.4
Ireland	3.7	0.6	19.5	5.5	0.3	12.2	59.4	0.9	62.5
Italy	8.9	1.4	2.0	58.0	3.1	5.3	115.1	1.8	10.7
Netherlands	19.2	3.1	11.1	67.0	3.5	23.6	247.6	3.9	67.1
Portugal	3.7	0.6	12.8	10.6	0.6	15.3	26.6	0.4	25.3
Spain	5.1	0.8	2.4	65.9	3.5	13.4	142.4	2.3	25.3
Sweden	2.9	0.5	2.3	12.5	0.7	5.4	77.0	1.2	33.9
U. K.	63.0	10.2	11.7	203.9	10.8	20.8	482.8	7.6	33.8
Other EU countries	15.1	2.4	8.9	47.0	2.5	13.4	125.2	2.0	30.5
Total	615.8		6.0	1889.0		9.2	6314.3		20.2

Source: UNCTAD, *World Investment Report.*

On the one hand, the growth of FDI in these countries is determined by their progress in transition and macroeconomic stabilization. Countries begin to receive significant inflows of FDI after their economies are more or less stabilized. Thus, in most of the countries in the first group, inflows increased to a significant level only in the second half of the nineties. Compared with the countries in the first group, distortions in factor markets and macroeconomic instabilities are still prevalent in most of the countries in the second group. Table 2 indicates the Flows of Direct Investment for EU countries in million US $. Despite the relatively short history of the

presence of foreign firms, companies with foreign participation already play a critical role in some economies of the first group. In Hungary, Estonia, Latvia and the Czech Republic, these companies' contribution to value added, foreign trade and GDP is exceedingly significant, even by international comparison. However, in some cases, the beneficial impact of companies with foreign participation on the host economy is arguably limited, on account of underdeveloped linkages with local companies.

German investments abroad remained on the record high level of the previous year, and were also led by M&A. The four largest mergers in which German investors participated accounted for more than half of total investments abroad. The most important host countries were the United States and the United Kingdom, accounting for 45% and 23% of German FDI outflows, respectively. The *Netherlands* witnessed a decrease over the previous year's record high capital movements. While still experiencing high inflows, *Spain* became a large investor, mainly due to its increased activity in Latin America. *Sweden* became one of the largest recipients of FDI. The country absorbed almost the same amount of FDIs inflows as in the previous decade put together. The record-high inflows (almost USD 60 billion) were due to an M&A deal in the chemical industry, which accounted for around two-thirds of the value of total inflows. The *Czech Republic* and *Poland* increased the level of FDI inflows due to large' privatization projects. Together with *Hungary*, they are still on the net receiving

Table 2
Direct Investment Flows for E.U. (million US $).

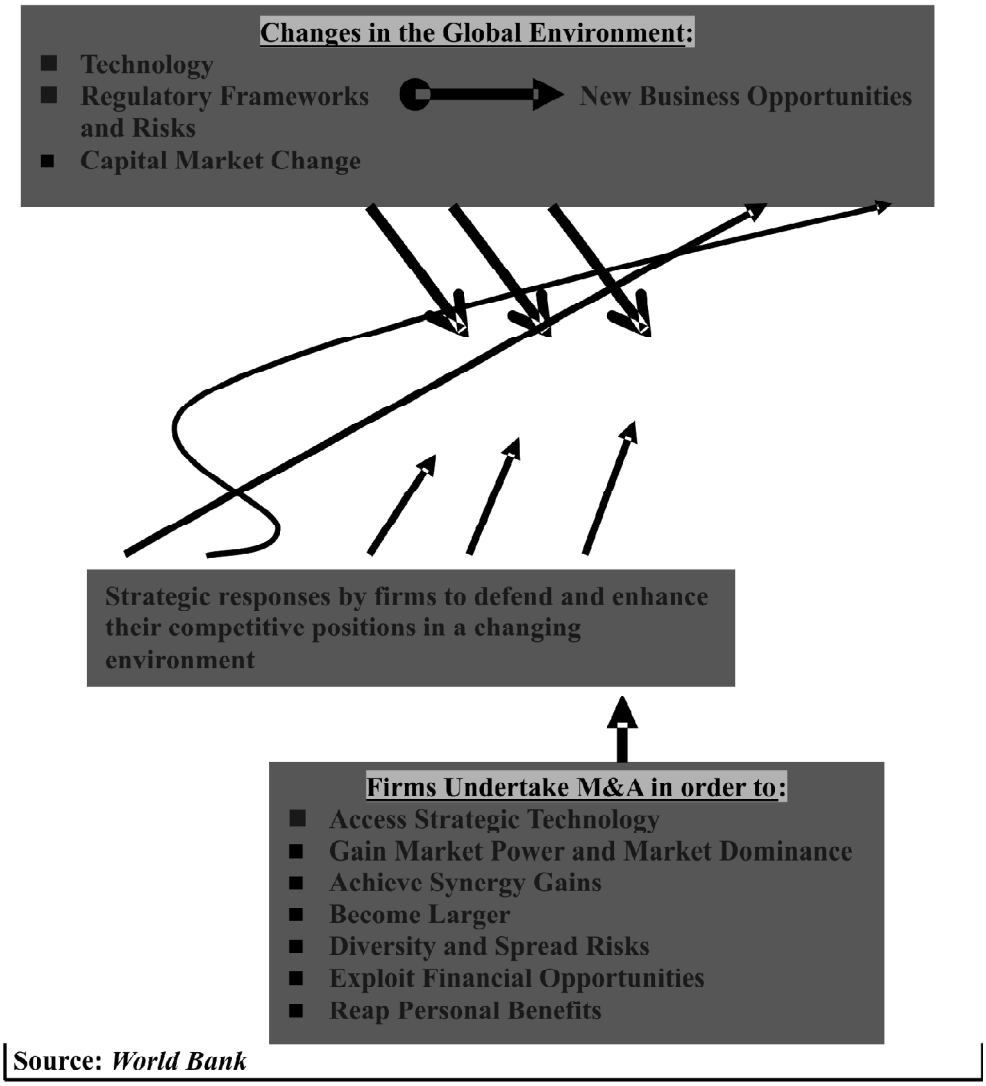
	Inflows				*Outflows*			
	1996	*2000*	*2004*	*2005*	*1996*	*2000*	*2004*	*2005*
Austria	4429	8842	3687	8905	1935	5741	7392	9382
Belgium	..	..	42064	23710	..	..	33545	22946
Czech	1428	4980	4975	10988	153	43	1014	856
Denmark	768	31306	-10721	5020	2519	23093	-10371	8072
Finland	1109	8836	3539	4558	3597	24035	-1076	2703
France	21960	43258	31388	63540	30419	177482	57044	115607
Germany	6573	198313	-15123	32643	50806	56567	1884	45606
Greece	1196	1108	2103	606	..	2137	1030	1450
Hungary	3300	2763	4657	6700	-4	620	1122	1346
Ireland	2616	25784	11165	-22759	728	4630	15813	12931
Italy	3535	13377	16824	19498	6465	12318	19273	41536
Luxemb.	..	..	77260	43729	..	..	81711	52368
Netherlands	16660	63866	442	43604	32098	75649	17292	119382
Poland	4498	9343	12355	7724	53	16	778	1455
Portugal	1344	6637	2368	3112	728	8134	7963	1146
Spain	6821	39582	24775	22973	5590	58224	60567	38748
Sweden	5437	23245	-1852	13692	5025	40667	11947	26029
U. K.	24441	118824	56253	164499	34056	233488	94929	101080
E. U.15	110812	803966	244171	427329	181777	940528	398942	598986
Total OECD	246294	1289314	490895	621682	343174	1239005	781787	716062

Note: Data are converted using the yearly average exchange rates.
Source: OECD /FDI Database (Based on national sources).

end of the FDIs spectrum, as the companies in each country have been able to invest only negligible amounts abroad.

Greece, *Portugal* and *Turkey* continued to experience low inflows. On the other hand, Portugal has been playing an increasingly active role on the outflow side in the last few years, effectively becoming a net investor abroad.

Graph 1
Cross Border FDI and M&A Activity



Source: ***World Bank***

Table 3
Matrix of Inward FDI Performance and Potential Performance

	2000 – 2005 *High FDI Performance*	*2000 – 2005* *Low FDI Performance*
High FDI potential	Front runners Bulgaria, Croatia, Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Portugal, Slovakia, Slovenia, Spain	Below potential Greece, Italy
Low FDI potential	Above potential	Under performers Romania
	1993 – 1995 *High FDI Performance*	*Low FDI Performance*
High FDI potential	Front runners Czech Republic, Estonia, Hungary, Malta, Poland, Slovakia, Spain	Below potential Bulgaria, Cyprus, Greece, Italy, Portugal, Slovenia
Low FDI potential	Above potential Latvia	Under performers Lithuania, Romania
	1988 – 1990 *High FDI Performance*	*Low FDI Performance*
High FDI potential	Front runners Cyprus, Greece, Malta, Portugal, Spain	Below potential Hungary, Italy, Poland
Low FDI potential	Above potential	Under performers

Source: UNCTAD, *World Investment Report*, 2004

Table 4
Mergers & Acquisitions: Cross–Border Sales & Cross–Border Purchases

M&A cross-border Sales								
	1995	*1996*	*1997*	*1998*	*1999*	*2000*	*2001*	*2002*
Greece	50	493	99	21	191	245	1.854	65
Turkey	188	370	144	71	68	182	1.019	427
United Kingdom	36.392	31.271	39.706	91.081	132.534	108.029	68.558	52.958
European Union	75.143	81.895	114.591	187.853	357.311	586.521	212.960	193.942
Developed Countries	163.950	187.616	232.085	443.200	679.481	1.056.059	496.159	307.793
World	186.593	227.023	304.848	531.648	766.044	1.143.816	593.960	369.789
M&A cross-border Purchases								
	1995	*1996*	*1997*	*1998*	*1999*	*2000*	*2001*	*2002*
Greece	…	2	2.018	1.439	287	3.937	1.267	139
Turkey	19	356	43	4	88	48	…	38
United Kingdom	29.641	36.109	58.371	95.099	214.109	382.422	111.764	69.220
European Union	81.417	96.674	142.108	284.373	517.155	801.746	327.252	213.860
Developed Countries	173.139	196.735	269.276	508.916	700.808	1.087.638	534.151	341.116
World	186.593	227.023	304.848	531.648	766.044	1.143.816	593.960	369.789

Source: UNCTAD, 2003

Germany, the United Kingdom and Japan were the largest net investors in the nineties, and the United States is the largest net recipient. Table 3 indicates the matrix of inward FDI performance and potential performance. Graph 1 illustrates the relationship and the effects of FDI and cross-border M&A to global socio-economic environment and at the firm level. Table 4 indicates the mergers and the acquisitions for both cross-border sales and purchases. Inefficient investment has also been a hindrance for many countries, although, again, causality is difficult to infer. Not surprisingly, in the developing countries with declining per capita growth during the last three decades, the incremental output-capital ratio (the inverse of the incremental capital-output ratio), which is a very rough proxy for the productivity of investment, was lower on average than in the countries that were growing.

FDI, INNOVATION AND GROWTH PROCESS: THEORY AND MODELS

Economists have analyzed different possible views of why productivity growth has declined. These alternative explanations can be grouped into the following categories:

- (a) the capital factor, for instance investment (FDI) may have been inadequate to sustain the level of productivity growth;
- (b) the technology factor which affects the productivity level, for instance a decline in innovation activities can affect productivity growth;
- (c) the increased price of raw materials and energy;
- (d) government regulations and demand policies that affect the productivity level;
- (e) the skills and experience of labour force may have deteriorated or moreover workers may not work as hard as they used to;
- (f) the products and services produced by the economy have become more diverse;
- (g) productivity levels differ greatly across industries.

Investment motives refer to economic advantages provided to foreign enterprises by a government, so that they are encouraged to locate in the specific potential host country. The motives of location choice can be categorized in four general categories:

- motives related to the expected demand in a certain region
- motives related to the factors of cost
- motives related to the agglomeration effects, and
- the motives related to the public policies of attracting investment capital.

Motive categories	*Type of motives*	*References*
First Category: Motives related to the expected demand	Market size or market potential	Tinbergen (1962), Linnemann (1966), Woodward (1992), Dunning (1993), Andersen (1994), Meyer (1996), Lankes and Venables (1997), Pye (1997, 1998), Haufler and Wooton (1999), Kurz and Wittke (1997), Altzinger (1999), Benacek *et al.* (2000), Bevan and Estrin (2000), Cheng and Kwan (2000), Stirboeck (2002), Chakrabarti (2003), Head and Mayer (2004), Basile (2004)
	Gross Domestic Product	Mody and Srivasan (1998), Hall and Jones (1999), Altomonte (2000), Bevan and Estrin (2000), Morisset (2000), Stevens (2000), Roll and Talbott (2001), Benacek *et al.* (2000), Coughlin, Terza and Arromdee (1991), Dunning (1993), Pye (1997, 1998), Iammarino and Pitelis (2000), Stirboeck (2002)
	Population density	Stirboeck (2002)
	Access to national and regional markets	Andersen (1994), Lankes and Venables (1997), Pye (1997, 1998), Cheng and Kwan (2000), Redding and Venables (2004), Disdier and Mayer (2004), Head and Mayer (2004)
	Barriers to international activity	Tinbergen (1962) and Linnemann (1966)
Second Category: Motives related to the factors of production cost	Tenure of natural resources	Dunning (1993), Andersen (1994), Lankes and Venables (1997), Kurz and Wittke (1997), Iammarino and Pitelis (2000), McCann *et al.* (2002)
	Access to low-cost labour	Meyer (1996), Lankes and Venables (1997), Pye (1997, 1998), Chakrabarti (2003)
	Wage costs adjusted for Quality of human capital or labour productivity,	Terza and Arromdee (1991), Vincentz (1995), KPMG International (1998), Altzinger (1999), Iammarino and Pitelis (2000), Cheng and Kwan (2000), Bevan and Estrin (2000), McCann *et al.* (2002)
	Labour market conditions	Cheng and Kwan (2000), Woodward (1992), McCann *et al.* (2002)
	Production costs	Hoover and Giarratani (1985), Andersen (1994) , Meyer (1996), Benacek *et al.* (2000), Redding and Venables (2004), Disdier and Mayer (2004), Basile (2004)
	Specialized working force.	Pye (1997, 1998), KPMG International (1998), Globerman and Shapiro (2002), McCann *et al.* (2002)
	Level of infrastructure	Cheng and Kwan (2000), KPMG International (1998), Southeastern European Cooperative Initiative (SECI, 1998), Basile (2004)
	Productivity rates	Mody and Srivasan (1998), Hall and Jones (1999), Altomonte (2000), Bevan and Estrin (2000), Morisset (2000), Stevens (2000), Roll and Talbott (2001)

Third Category: Motives related to the agglomeration effects	Distance	Tinbergen (1962) and Linnemann (1966)
	Availability and quality of infrastructure	Cheng and Kwan (2000), Globerman and Shapiro (2002)
	Economies of agglomeration	Cheng and Kwan (2000)
	Economic openness	Stirboeck (2002)
	Capital market integration	Stirboeck (2002)
	Peripheral or central location of the region	Stirboeck (2002)
	Cost of transport	Basile (2004), Chakrabarti (2003), McCann *et al.* (2002)
	Geographic degree of concentration	Coughlin, Terza and Arromdee (1991), Andersen (1994), Meyer (1996), Lankes and Venables (1997), Pye (1997, 1998), KPMG International (1998), Altzinger (1999), Iammarino and Pitelis (2000)
Fourth Category: Motives related to the public policies	Policy liberalisation	Cheng and Kwan (2000) UNCTAD (2001), Chakrabarti (2003)
	Policy toward FDI	Cheng and Kwan (2000), Haufler and Wooton (1999), Chakrabarti (2003), Southeastern European Cooperative Initiative (SECI, 1998), Iammarino and Pitelis (2000)
	Political, economic and legal environment	Lucas (1990), Andersen (1994), Lankes and Venables (1996), Bevan and Estrin (2000), Iammarino and Pitelis (2000), Lucas (1993), Jun and Stogh (1996), Chakrabarti (2003), Globerman and Shapiro (2002)
	Institutional quality of the host country	Dunning (1981), Beckman and Thisse (1986), Vickerman (1990), Lucas (1993), Jun and Stogh (1996), Puga and Venables (1996), Fujiita *et al.* (1999), Head *et al.* (1999), Hall and Jones (1999), Altomonte (2000), Bevan and Estrin (2000), Morisset (2000), Stevens (2000), Roll and Talbott (2001), Castellani and Zanfei (2003), Basile *et al.* (2004), Disdier and Mayer (2004), Chakrabarti (2003), Lucas (1990), Lankes and Venables (1997), Iammarino and Pitelis (2000), Globerman and Shapiro (2002), McCann *et al.* (2002)
	Macroeconomic stability	Lucas (1993), Jun and Singh (1996), Holland and Pain (1998), Resmini (2000), Meyer (1996), Lankes and Venables (1997), Pye (1997, 1998), KPMG International (1998), Southeastern European Cooperative Initiative (SECI, 1998), Benacek *et al.* (2000)
	Institutional stability	Lucas (1990), Jun and Singh (1996), Holland and Pain (1998), Resmini (2000), Andersen (1994), Meyer (1996), Pye (1997, 1998), KPMG International (1998), Southeastern European Cooperative Initiative (SECI, 1998)

Political stability	Lucas (1993), Jun and Singh (1996), Holland and Pain (1998), Resmini (2000), Andersen (1994), Meyer (1996), Lankes and Venables (1997), Benacek *et al.* (2000)
General investment dangers	Bevan and Estrin (2000), Chakrabarti (2003)

A higher level of Foreign Direct Investment and consequently the Innovation and Research activities tend to have a higher level of value added per worker (or a higher GDP per head) and a higher level of innovation activities than others. Following this argument, it would be expected that the more attracted of FDI and technologically advanced countries would be the most economically advanced (in terms of a high level of innovation activities and in terms of GDP per capita).However, the level of technology in a country cannot be measured directly. A proxy measure can be used to give an overall picture of the set of techniques invented or diffused by the country of the international economic environment. For the productivity measure, we can use the real GDP per capita as an approximate measure. The most representative measures for *technological inputs and outputs* are the indicators of patent activities and the research expenditures. The only possible way for technologically weak countries to converge and *catch up* on the advanced countries is to imitate the more productive technologies. The outcome of the international innovation and diffusion process is uncertain; this process may generate a pattern where some countries follow diverging trends or a pattern where countries converge towards a common trend.
In this literature, economic development is analysed as a disequilibrium process characterized by two conflicting forces:

(a) innovation which tends to increase economic and technological differences between countries and

(b) diffusion (or the imitation), through FDI, which tends to reduce them.

Technological gap theories are an application of Schumpeter's dynamic theory. Whatever the form of the independent variable, a positive relation between productivity and national patent activity exists. However, there is a negative relationship between productivity and gross expenditures on R&D; this can be interpreted as due to the weak level of reliability of the gross research expenditure data as an explanatory variable of innovation activities. As expected, the best results are obtained for the logarithmic models, which imply a steeper curve. Patenting data reflect the innovation process better, while the research indexes reflect both imitation and innovation processes. Research and development data reflect imitation, innovation and diffusion activities. The relation between productivity (as measured by GDP per capita) and innovation activities should be expected to be log linear rather than linear and steeper for the patent data than for the index based on research data. For the structural change we used as an approximation changes in the shares of exports and agriculture in GDP. *Technological gap models* as developed here have little

to say on how to achieve higher growth of innovation activities or the exploitation of diffusion and innovation. Since annual observations are heavily affected by the short-run fluctuations, average values of the variables covering the period 1973-2007 were calculated. We have tested the following version of the models:

$$\text{GDP (or PROD)} = f\,[\text{GDPCP, EXPA (or GERD), INV}], \text{ (basic model)}, \quad (1)$$

$$\text{GDP (or PROD)} = f\,[\text{GDPCP, EXPA (or GERD), INV, EXP}], \quad (2)$$

$$\text{GDP} = f\,[\text{GDPCP, EXPA (or GERD), INV, TRD}], \quad (3)$$

The first model may be regarded as a pure *supply model*, where economic growth is supposed to be a function of the level of economic development GDPCP (GDP per capita with a negative expected sign), the growth of patenting activity (EXPA with a positive sign) and the investment share (INV with a positive sign). However, it can be argued that this model overlooks differences in overall growth rates between periods due to other factors and especially differences in economic policies. The second model takes account of structural changes using as a proxy the share of exports in share of GDP. The third model uses an additional variable, which reflects the changes of macroeconomic conditions and suggest that growth rates are seriously affected by changes in the terms of trade.

For the level of productivity, we can use as a proxy real GDP per capita (GDPCP). For the measurement of *national technological level*, we can use some approximate measures; for instance, we can again use the traditional variables of *technological input* and *technological output* measures, (GERD and EXPA). The majority of empirical studies in the estimations between productivity growth and R&D follow a standard linear model; on this context we use a similar approach. The reason is that even though a more dynamic relationship exists, the data limitations (lackness of time series annual data on R&D activities for most countries) prevent the application of some complex models. We may use the external patent applications (EXPA) and gross expenditures on research and development (GERD) as proxies for the growth of the national technological activities, GDP per capita (GDPCP) (in absolute values at constant prices) as a proxy for the total level of knowledge appropriated in the country (or *productivity*). Investment share (INV) has been chosen as an indicator of growth in the capacity for economic exploitation of innovation and diffusion; the share of investment may also be seen as the outcome of a process in which institutional factors take part (since differences in the size of investment share may reflect differences in institutional system as well).

The models are tested for the EU member states (countries Belgium and Luxembourg considered as a single country and including in the new members). The basic model is tested for the variables of GDP, GDP per capita, external patent applications and investment as a share of GDP. The results are presented in the above Table 5. In both cases we are using the same approach with firstly basic model and then introducing terms of trade and the export variables. It is worth noting that for

Table 5
Basic Model Tested for a Selection of European Member States, (1973-2007):(*)

- **The basic model including patents:**

GDP=2.824-0.002GDPCP+0.10EXPA+0.027INV
t=(1.53) (-3.30) (2.30) (0.32), R2=0.52 (adj.d.f:0.39) DW=1.52,
Rho(autocorrelation coefficient)=0.385, t=1.475.
The logarithme model:
LGDP=1.499-0.384LGDPCP+0.155LEXPA+0.806LINV
t=(0.593) (-2.569) (0.930) (1.340), R2=0.56 (adj.d.f:0.42) DW=1.36,
Rho (autocorrelation coefficient)=0.297, t=0.985.

- **The basic model including patents:**

PROD=0.453-0.00015GDPCP-0.0198EXPA+0.174INV
t=(-0.386) (-3.979) (-0.245) (3.012), R2=0.64 (adj.d.f:0.54) DW=1.49,
Rho(autocorrelation coefficient)=0.301.
The logarithmic model:
LPROD=-0.566-0.384LGDPCP-0.131LEXPA+1.558LINV
t=(-0.220) (-2.519) (-0.770) (2.541), R2=0.75(adj.d.f:0.66) DW=1.38,
Rho (autocorrelation coefficient)=0.241, t=0.786.

- **The basic model including the gross expenditures on R&D:**

GDP=1.775-0.00129GDPCP+0.0142GERD+0.0646INV
t=(0.92) (-1.86) (0.21) (0.75), R2=0.40 (adj.d.f:0.24) DW=2.30,
Rho (autocorrelation coefficient)=-0.153, t=-0.539.
The logarithm model:
LGDP=0.619-0.275LGDPCP+0.00625LGERD+0.837LINV
t=(0.246) (-2.098) (0.0396) (1.408), R2=0.47(adj.d.f:0.33) DW=2.38,
Rho (autocorralation.coefficient)=-0.228, t=-0.815.

- **The basic model including the gross expenditures on R&D:**

PROD=0.349-0.00018GDPCP-0.0716GERD+0.168INV
t=(0.231) (-3.413) (0.933) (2.677), R2=0.66 (adj.d.f:0.57) DW=1.43,
Rho (autocorrelation coefficient)=0.301.
The logarithmic model:
LPROD=-0.404-0.421LGDPCP-0.0345LGERD+1.568LINV
t=(-0.130) (-2.585) (-0.176) (2.126), R2=0.61 (adj.d.f:0.50) DW=1.79,
Rho (autocorrelation coefficient)=-0.0131, t=-0.0402.

Note: (*)=Including the three prospective member states. The standard errors & the variance shown in the above examples that are heteroskedastic-consistent estimates. Definition of variables: GDP=annual average growth rates (1973-07) for real gross domestic product. PROD=annual average growth rates (1973-07) for product.(defined as labour prod:GDP per person employed). GDPCP=average absolute values constant (1985) prices (000 US $) for GDP per capita.EXPA=annual average growth rates for external patent applications.GERD=annual average growth rates for GERD. EXP=annual average growth rates (1973-07) for exports as a share of GDP.INV=annual average growth rates (1973-07) for investment as a share of GDP.TRD=annual average growth rates (1973-97) for terms of trade.LGDP, LPROD, LEXPA, LGERD, LEXP, LINV, LTRD are the above variables in a logarithmic form.

the first category of the more technologically advanced member states, the estimated coefficients display the expected signs except for exports (EXPA) and gross expenditure on R&D (GERD).

The results do not support the hypothesis of structural changes as independent, causal factors of economic growth. These results can be interpreted in order to support the view that the influence of change in outward orientation on growth depends on international macroeconomic conditions (since random shocks and crises and slow growth in world demand in the 1970s, 1980s and 1990s restrained the growth of outward oriented countries). According to these results, the coefficient of investment (INV) has the wrong sign. In terms of data, it is not difficult to see why this happened. For instance, during the whole period under examination, only the more advanced countries have a large capacity for innovation activities; they had already established a technological infrastructure and they could produce a large number of patents, while the second group were trying to establish and upgrade their technological infrastructure. The results show that the degree of explanation is very high, (above 80 per cent); most of the variables are statistically significant, while the standard errors and the variance shown are heteroscedastic consistent estimates.

We can classify four-groups using four different scientific criteria of UNESCO, so to be able to measure and to evaluate the *technological efficiency and capabilities strength through FDI*. Table 6 illustrates the classification according to scientific and research criteria through FDI. The first criterion refers to the *scientists and engineers engaged in research activities per million inhabitants (full-time equivalents)*. Figures 1(a)-1(d) illustrate the Patents granted by US Trademark Office (UPSTO), the total Public Expenditure on Education as a percentage of GDP, and also the EU innovation gap towards EU-US and also EU-Japan, respectively.

Figure 1(a): Patents Granted by U. S. Patent & Trademark Office (USPTO)

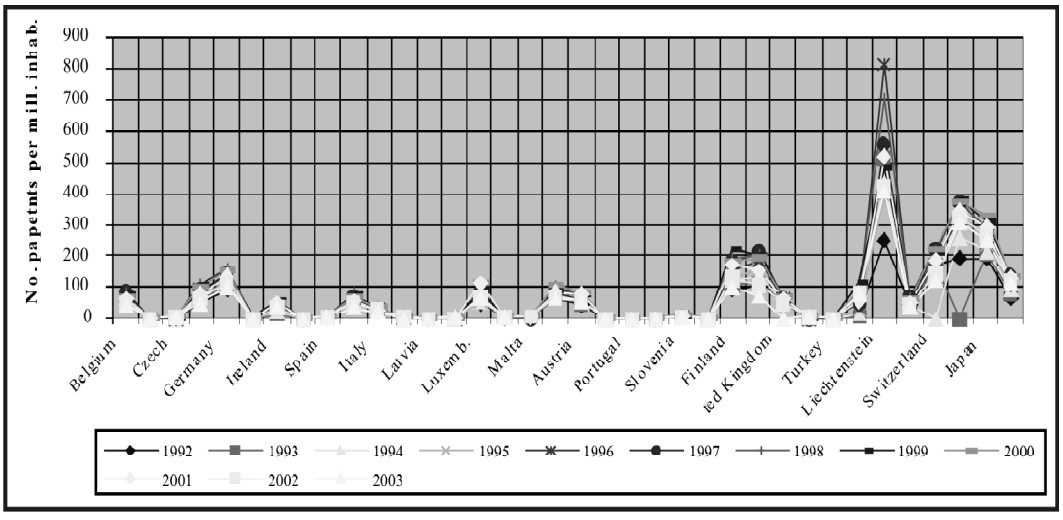


Figure 1(b): Total Public exp. on Education as a Percentage of GDP

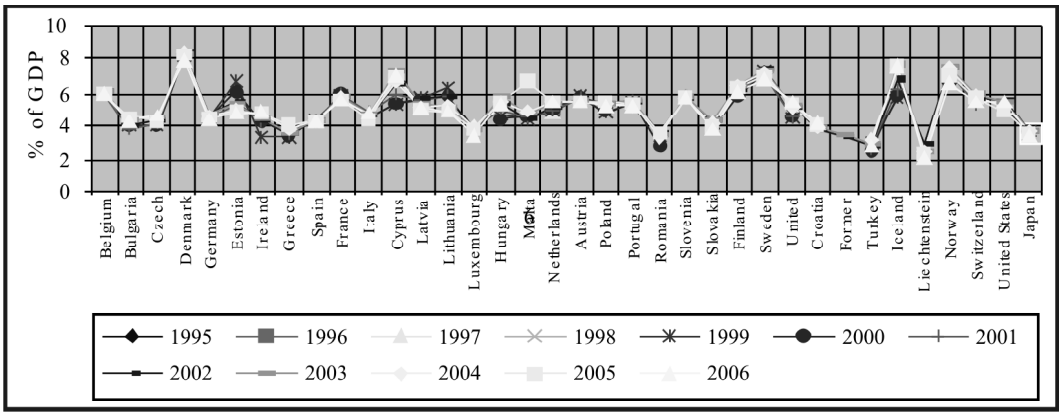


Figure 1(c): EU Innovation Gap towards EU & US

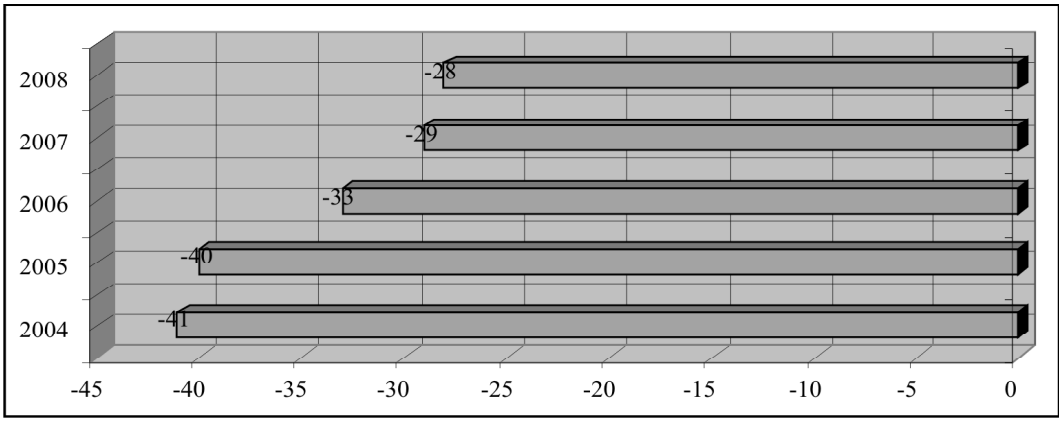


Figure 1(d): EU Innovation Gap towards EU & Japan

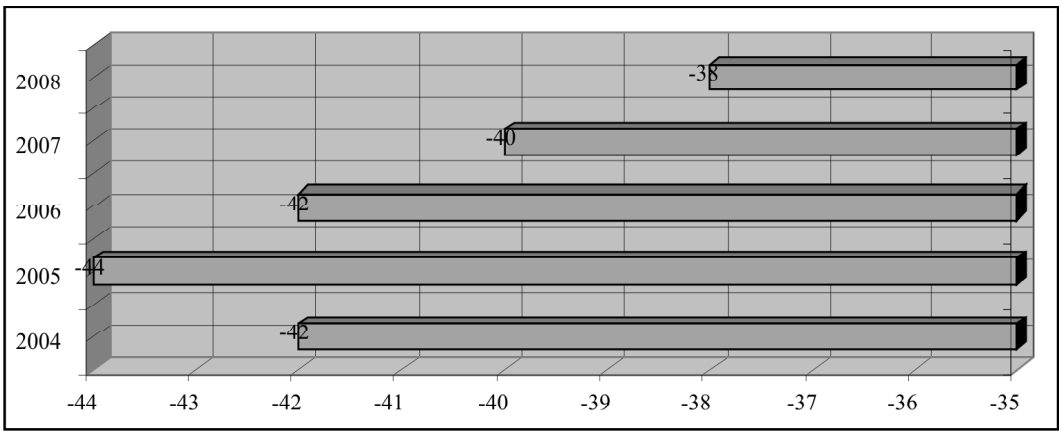


Table 6
Classification of Scientific and Research Capabilities

Groups of S&T capabilities	*Countries*
Group A:	Most underdeveloped countries (without S&T capabilities)
Group B:	Most developing countries(with some fundamental elements of S&T base)
Group C:	New & semi-industrialized countries (i.e. Greece, Israel Finland, Singapore, New Zealand and so on (with S&T base established)
Group D:	Industrialized countries:(advanced EEC states) with effective S&T base.

Source: UNESCO, "Science & Technology in Developing Countries-Strategies-1990s".

Using the second criterion of research and development personnel in higher education per thousand inhabitants, full-time equivalent; the countries which had established some initial elements of innovation activities. The third criterion refers to the *third level students per 100,000 inhabitants*; according to this, indicating those countries with an effective scientific and technological apparatus.

CONCLUSIONS AND POLICY IMPLICATIONS

Technology transfer through FDI is an important factor on the process of economic development and economic performance. MNEs and FDIs are the main policy tools for the international technology transfer and the development of innovation activities in many countries. Multinationals also produce and control most of the world's advanced technology. About four fifths of the FDIs and the production of advanced technology originates from the Japan, Germany, United Kingdom, United States and Switzerland.

Technology transfer through MNEs and FDIs lead to a geographical diffusion of technology and contribute substantially towards the development of research and innovation activities in the less technologically advanced countries. Most of these countries are lacking the funds and the opportunities to develop their own technologies and they aligned on the policies of technology transfer through MNEs. However, multinationals transfer only the technologies that needed and have been developed abroad from the host laboratories. The ownership and the control of new technologies from MNEs does not automatically implies the improvement and the development of research activities at a national level.

Most of the empirical studies emphasized the profits, the age and the amount of new technologies transferred by MNEs. Usually, the affiliate companies operate in a monopolistic market where the new technologies gives its products a *quality advantage* and a higher market share.

SMEs (Small Medium enterprises) in less favored regions may need assistance in tapping into the necessary resources (related to knowledge, in the form of technology

or qualified human capital in particular), to face up to the new forms of competition developing in the global economy. Regional innovation policy may help stimulate firms, SMEs in particular, in less favored regions to adopt improved production methods (e.g. quality and environmentally friendly processes, incorporation of technological developments and innovation management methods, etc), make new/ different products and services (e.g. : design, customization, etc), and exploit new economic opportunities and markets (university spin-offs, new technology-based firms, etc). Thus using their regional innovation potential to the full in order to compete in the global economy.

Regional policy has to cope with fresh challenges, globalization and rapid technological change in particular, in order to provide the economic opportunities and quality jobs needed in less favored regions.

Today, the innovation-gap is nearly twice as great as the cohesion gap. Many of the causes of disparities among regions can be traced to disparities in productivity and competitiveness. Education, research, technological development and innovation are vital components of regional competitiveness.

According to the fourth measure of the *percentage of manufacturing in GDP and the growth of manufacturing in the value added*, for those which had established a scientific apparatus. Finally using the measure of *scientific and capabilities strength* indicate these countries that have established some initial elements of research and technological apparatus.

Long-term foreign private capital flows have a complementary and catalytic role to play in building domestic supply capacity as they lead to tangible and intangible benefits, including export growth, technology and skills transfer, employment generation and poverty eradication. Policies to attract FDI are essential components of national development strategies.

The inter-regional innovation-gap is not only of a quantitative nature but also of a qualitative one. There are a number of characteristics of regional innovation systems in less advance regions which make them less efficient:

- *Firms may not be capable of identifying their innovation needs* or maybe unaware of the existence of a technical solution.
- *There may be poorly developed financial systems* in the area with few funds available for risk or seed capital, which are specifically adapted to the terms and risks of the process of innovation in firms.
- *There may be a lack of technological intermediaries* capable of identifying and 'federating' local business demand for innovation (and RTD&I) and channelling it towards sources of innovation (and RTD&I) which may be able to respond to these demands.
- *Co-operation between the public and private sectors may be weak*, and the area may lack an entrepreneurial culture which is open to inter-firm co-operation,

leading to an absence of economies of scale and business critical mass which may make certain local innovation efforts profitable.

- *Traditional industries and small family firms may dominate* which have little inclination towards innovation. There may be a low level of participation in international RTD&I networks and a low incidence of large, multinational firms.

Given all the above, we believe that regional policy should increasingly concentrate its efforts on the promotion of innovation to prepare regions for the new economy and close the 'technology gap' if it is to be successful in creating the conditions for a sustained (and sustainable) economic development process in less favoured regions. Now, before we turn to what has been our policy response over the last decade and what our ideas about the future are, let me briefly pick up the second question.

Regional policy should evolve from supporting physical innovation infrastructure and equipment towards encouraging co-operation and a collective learning process among local actors in the field of innovation. A policy which facilitates the creation of rich, dynamic regional innovation systems and which assists in the exchange of skills and expertise which small and medium sized firms may not have available in-house.

In this context, a stable economic, legal and institutional framework is crucial in order to attract foreign investment and to promote sustainable development through investment. In this regard, a conducive international financial environment is also crucial. Promoting a conducive macro-economic environment, good governance and democracy, as well as strengthening structural aspects of the economy and improved institutional and human capacities, are important also in the context of attracting FDI and other private external flows.

Technological progress has become virtually synonymous with long run economic growth. It raises a basic question about the capacity of both industrial and newly industrialized countries to translate their seemingly greater technological capacity into productivity and economic growth. In the literature there are various explanations for the slow-down in productivity growth for OECD countries. One source of the slow-down may be substantial changes in FDI, and in the industrial composition of output, employment, capital accumulation and resource utilization. The second source of the slow down in productivity growth may be that technological opportunities have declined; otherwise, new technologies have been developed but the application of new technologies to production has been less successful. Technological factors act in a long run way and should not be expected to explain medium run variations in the growth of GDP and productivity.

On the basis of the previous discussion, the main conclusions and recommendations of this paper can be summarised as follows:

Technological gap models represent two conflicting forces, innovation which tends to increase the productivity differences between countries and diffusion which tends to reduce them. In the Schumpeterian theory, growth differences are seen as the combined results of these forces. Research on *why growth rates differ* has a long history which goes well beyond growth accounting exercises. The idea that the poorer countries should catch up on the richer ones was advanced already in the nineteenth century, in order to explain continental Europe's convergence with Britain. In the 1960s one of the most basic was the Marx-Lewis model of abundant labour supplies which explained the divergent growth experience in the Western European countries.

The countries that are technologically backward have a potentiality to generate more rapid growth even greater than that of the advanced countries, if they are able to exploit the new technologies which have already employed by the technological leaders. The pace of the catching up depends on the diffusion of knowledge, the rate of structural change, the accumulation of capital and the expansion of demand. The member states that are lagging behind in growth rates can succeed in catching up, if they are able to reduce the technological gap. An important aspect of this is that they cannot rely only on the combination of technology imports and investment, but they should increase their innovation activities and improve locally produced technologies (such as in the case of new industrialized countries Korea and Singapore).

However, our results confirm that some of the small and medium sized EU member states have attained high levels of GDP per capita without a large innovation capacity. To explain the differences in growth between these countries in the post-war period a much more detailed analysis of economic, social and institutional structures should be implemented. If we are comparing technologically advanced and less advanced member states, we can easily find that the less advanced countries lacked experience of large scale production, technical education and resources.

Conclusions cannot be easily drawn from simple summary measures of the extent or the rate of compositional structural change, without having some additional information regarding the direction of change, the path followed from the previous industrial structure and associated and institutional factors.

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