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Working Party on Globalisation of Industry

LOCATION CRITERIA OF ACTIVITIES RELATED TO INNOVATION: AN ECONOMETRIC STUDY ON OECD AFA AND FATS DATA BASES

(Note by Fabrice Hatem)

This document, prepared by Fabrice Hatem, is submitted for discussion under item 5 of the draft agenda of the WPGI meeting to be held on 27 October 2009. Delegates are invited to discuss this report and suggest possible improvements in the perspective of a future publication.

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EXECUTIVE SUMMARY

As the rest of the economy, innovation-related activities (IRA) [1] have gone through a steady internationalisation process in the recent years. This trend has consequently led to a growing awareness of host territories regarding the need to offer a favourable environment to companies willing to develop their innovation-related activities in the most attractive location. This concern is of special importance for OECD countries, which have to rely heavily on these innovation-related activities to make up for the decline of some of their traditional manufacturing industries.

At the request of the OECD secretariat, an econometric study has thus been implemented on the international location criteria of innovation-related activities (IRA). These activities include, on the one hand, high and medium high tech industries, as defined by OECD (OECD, 2007), and, on the other hand, all business R&D activities. OECD's AFA and FATS data base on activities of MNEs abroad have been used as the major sources of data for the explained variables.

The results of this econometric study show the importance of market size, agglomeration effects, and, to a minor extent, the quality of public governance for the location of international activities in innovation-related activities. The overall degree of the country's openness to FDI also appears to be a significant location determinant. As expected, the location of foreign-controlled R&D expenditures seems very sensitive to the overall size and/or efficiency of the domestic innovation system, as measured by R&D expenditures as well as by patents.

Another important finding of the study is that there are significant differences in location criteria depending on the nature of the explained variable. The level of foreign- controlled value added is mostly sensitive to access to market and industrial agglomeration effects. Employment (expressed in terms of headcounts) is the only variable for which labour costs play a significant role as a location criteria. Foreign controlled R&D expenditures are very sensitive, as could be expected, to innovation related criteria (such as total domestic R&D expenditures and patents granted to residents).

These results give interesting insights on the possible existence of global location strategies carried out by MNEs in order to internalise the competitive advantages of each of the potential host countries by locating each segment of their product value chain in the places most fitted for this kind of activities. While some general requisites (such as the proximity to market, a favourable business environment, an openness to FDI) will be influential for all kind of activities, the most labour intensive segments will be located, as expected, where labour is cheap, the most R&D intensive where the national innovation system is efficient, while overall value added in monetary terms will be produced where there is already a significant industrial base and where skilled labour is available.

While this global model seems to be fully instrumental in many manufacturing industries, such as electronic or automotive, it seems less relevant in some services industries, especially in telecommunication service, where access to market definitely seems to play a much more prominent role than other criteria such as resource or efficiency seeking strategies.

[1] The acronym IRA will be used in the rest of this report to refer to "innovation related activities".

The relative importance of the various criteria may also vary depending on the industry. For instance, labour cost play a less important role in pharmaceuticals and chemicals (both very capital intensive industries where per capita productivity is very high on average) than in automotive (a quite labour intensive industry employing large staffs of people in manufacturing plants).

These results bear a significant contribution to the existing knowledge on location criteria by industries and business functions. They also confirm the value of the AFA and FATS data bases as a major source of statistical information for the implementation of in-depth analytical studies on issues related to MNEs' internationalisation, location decisions and countries' attractiveness to foreign direct investment.

In addition to these finding for OECD countries, the analysis of other sources with a larger geographical scope show that, while emerging economies still only play a limited role in most of the innovation-related industries, they are presently attract a large share of new projects, due among others, to the quick growth rate of their market and the availability of large pools of labour force)

Faced to this growing competition from emerging economies, OECD countries should more than ever, consider the enhancement of their countries' attractiveness for international projects in IRA as a major policy priority. The stimulation of local markets for innovation-related products and services, the increased efficiency of the national innovation system, the improvement of the regulatory and administrative environment, the control of production costs, and the implementation of targeted promotion policies for IRA can be considered as the five major components of this agenda, as they correspond to the major location determinants of international projects.

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1. INTRODUCTION

1. After defining the major purposes of the study, this introduction provides insights on the methodology implemented and give an overview on the general structure and contents of the final report.

1.1 Major purposes of the study

2. The purpose of this study is to provide new evidences on the international location criteria of innovation-related activities (IRA)[2], on the basis of econometric approaches using the OECD AFA and FATS data bases on the foreign presence in OECD countries.

3. As the rest of the economy, innovation-related activities (IRA) have gone through a steady internationalisation process in the recent years, due to both the increasing fragmentation of the product value chains and to the desire of companies to locate closer to the major markets and sources of scarce resources.

4. This trend has consequently led to a growing awareness of host territories regarding the need to offer a favourable environment to companies willing to develop their IRA in the most attractive location. This concern is of special importance for OECD countries, which have to rely heavily on these innovation-related activities to make up for the decline of some of their traditional manufacturing industries.

5. However, while they remain dominant in IRA, OECD economies are confronted to a growing competition by emerging economies, which can rely both on quickly expanding final markets, low production costs and growing technological and industrial capabilities.

6. Faced to this challenge, OECD countries have to implement policies aimed at fostering their competitive advantages in IRA. For this purpose, they need to know better what are the investors' requests regarding their business environment. As many of these investors are MNEs which have the choice between different countries to set up their activities, this question is closely related with that of the location criteria of international investment projects.

7. Among the most common findings of the existing literature is the fact that the role of access to market as a major location determinant, in IRA as in many other industries. The availability of skills and the efficiency of the local innovation system also play an important role for upstream R&D and high value added manufacturing, while a large range of activities are also sensitive to cost-efficiency criteria, for instance in labour-intensive manufacturing, but also, increasingly, in development functions.

8. The knowledge corpus on location criteria however remains scarce and focused on only a limited set of specific issues. While a large amount of literature has already been dedicated to the location determinant of R&D activities, findings remain scarcer at the overall industry level. Systematic studies of specific location criteria for each of the functions and steps of the value chain, allowing comparisons on a homogenous basis, have been implemented in only a limited number of cases.

[2] The acronym IRA will be used in the rest of this report to refer to "innovation related activities".

9. Another shortcoming of the existing literature is the scarcity of comparative analysis regarding the sensitiveness of the results to the way the explained variable is measured (foreign controlled employment, production, value added, flows of new projects, number of existing subsidiaries, FDI flows and stocks, etc.). Though, there are obvious reasons to believe that the hierarchy of location criteria may differ substantially, in the same industry, depending upon the nature of the activity carried out abroad and the way it is measured.

10. There is thus a need for additional studies to identify various hierarchies of location criteria depending on the nature of activities located abroad and the measurement modalities. Four major dimensions may be distinguished in this regard: 1) type of industry; 2) nature of the functions[3] (globally as well as industry-specific); 3) variable measured (employment, assets, sales, production, value added, etc); 4) nature of the measurement (level of activity in monetary value, number of existing subsidiaries, and flow of new projects…).

1.2 Methodology and statistical issues

1.2.1 Statistical issues

11. Innovation-related activities (IRA) are defined here following a two-dimensional approach (OECD, 2007): on the one hand, they include innovation related industries (IRI)[4] defined as those with a high of medium-high content in direct and indirect R&D (table 1). On the other hand, they include all business R&D activities, whatever the industry in which they are carried out.

12. According to OECD criteria, IRI manufacturing industries can be divided in two groups: high tech (C2423, C30, C32, C33 in the ISIC code, revision 3, level 2) and medium to high tech (all other manufacturing industries considered in table 1). In addition, some services industries, considered as innovation-intensive, are also included in the study (C64, C65T67, C72, C73, C74). All together, these activities account for not less than 34%, 26.1%, and 75.6% of value added, employment and R&D expenditures, respectively, in OECD economies.

13. Due to various limiting factors (especially the low availability of data in services industries); the study will be mainly focused on manufacturing industries.

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3 In this study, we shall put a special focus on two of these functions : R&D and production As a matter of facts, it can be assumed a an initial hypothesis (to be later tested and confirmed of course) that location criteria in a number of administrative and technical support functions (such as headquarters, internal administrative functions, customer contact centres and logistics), as neither industry-specific nor particularly related to the problematic of innovation, and can thus be excluded, at least in the initial stage, from the scope of this study.

4 The acronym IRI will be used in the rest of this report to refer to "innovation related industries".

Table 1. Innovation related industries (IRI) considered in this study

ISIC CODE	Definition	R&D status	Share in OECD countries' economies		
			Value added	Employment	R&D expenditures
C24M2423	Chemicals exc. pharmaceuticals	Medium-high tech	1	0.5	4.9
C2423	Pharmaceuticals	High tech	0.6	0.2	11.6
C29	Machinery and equipment.	Medium-high tech	1.5	1.5	5.9
C30	Office and computing machinery	High tech	0.1	0.1	4.7
C31	Electrical machinery and apparatus	Medium-high tech	0.6	0.6	3
C32	Electronic equipments & components	High tech	0.7	0.6	13.8
C33	Precision and medical instruments	Medium-high tech	0.4	0.4	6.5
C34	Motor vehicles and trailers	Medium-high tech	1.3	1.1	11.8
C353	Aircrafts and spacecrafts	High tech	0.3	0.2	5.9
C64	Post and telecommunications	Medium-high tech	2.6	1.4	1.2
C65T67	Financial intermediation		6.7	3.4	1.1
C72	Computer related activities		1.8	1.3	5.2
C73	Research and development		0.3	0.4	
C74	Other business activities		8.7	9.6	
Total	Innovation related industries		34	26.1	75.6

Source: OECD, Stan data base. Data for the C73 industry only refer to the companies and/or subsidiaries the main activity of which is R&D. It thus does not include all the R&D activities of the business sector.

For value added, data are for the year 2005 and for 19 countries.

For employment, data are for the year 2005 and for 20 countries.

For R&D, data are for the year 2005 for 19 countries. Data for C353 include all transport equipments (C3500). Data for C64 include transports (C60TC64). Data for C72 to C74 also include real estate (C70)).

1.2.2 Methodology

14. As shown by a recent review of literature (Hatem & Py, 2008), studies on location criteria in IRA have been based on a very large array of methods and data: survey among decision makers, case studies, econometric studies on global FDI data or on individual data (regarding either exiting establishments or new location decision). The literature also includes a large range of geographical and industry scope, some studies being focused on very specific regions and/or activities, while other have a larger geographical or sector scope.

15. However, very few – if none – studies have so far been focused on a systematic comparison of location criteria for a large range of industries, with a broad international approach including a large list of host and home countries, and on the basis of long and detailed times series providing *aggregate* information on the overall level of foreign-controlled activities by country and industry.

16. The existence of the OECD's AFA and FATS data bases (table 2) makes it possible to overcome some of these shortcomings, at least for OECD countries. These data base provide internationally comparable time series on the foreign presence in each of the OECD countries, by year (since 1985 onwards) and industry (up to level 2 of the ISIC rev. 3 classification). In addition, a large set of variables on the foreign presence (value added, employment, R&D expenditures, production, etc.) are available in these data bases, which allows interesting comparisons on the relative importance of location criteria depending on the kind activity carried out abroad and/or the way it is defined.

Table 2. Various data base used to analyse internationalisation trends and location criteria

Name	Developer/ owner	Contents
Data bases specific to internationalisation and international investment		
AFA	OECD	Aggregate data on foreign presence in OECD countries, by industries in the manufacturing and primary sectors (around 15 variables by industry, ISIC rev. 3, level 2).
FATS	OECD	Aggregate data on foreign presence in OECD countries, by industries in the services sector (around 15 variables by industry, ISIC code rev. 3 level 2).
Thomson One Banker	Thomson Reuters	Data base on individual companies accounts worldwide, including foreign assets, sales, employment and affiliates
Thomson Financial	Thomson Reuters	Data base on individual M&A operations, including cross-borders.
FDI markets	OCO Consulting/ Financial Times	Data base in individuals international greenfield investment projects worldwide (each projects being described by around 15 parameters (home and host country, date, number of jobs, industry, business function, etc.).
UNCTAD FDISTAT	UNCTAD	Aggregate data on FDI flows and stocks times series worldwide, by home and host country, and by industry.
General data bases		
U-Klems data base	U-Klems project	Data base on measures of economic growth, productivity, employment creation, capital formation and technological change at the industry level for all European Union member states from 1970 onwards
World Competitiveness Yearbook data base	IMD	Data base on national competitiveness criteria (around 200 criteria for 60 countries, with time series since 1989).
STAN	OECD	Structural aggregated data at the industry level for each OECD country (around 20 parameters by industry).

17. The major purpose of this study is to take advantage of these possibilities by implementing a panel econometric study aimed at identifying, for each of the major innovation-related industries, the major location criteria of foreign activities, on the basis of aggregate data on foreign presence by host country in the OECD area. For each industry, this analysis will be implemented for five different indicators of foreign presence (value added, FDI stocks, number of foreign affiliates, employment, R&D expenditures), in order to identify specific location behaviour depending on the nature of the activity carried out abroad by MNEs.

18. In each of these five cases, a specific explanatory model will be built and tested in order to give insights on questions of obvious interest, such as: is the location of R&D abroad especially sensitive to the quality of the host country's innovation system and the availability of scientific infrastructures? Is the location of jobs (in term of headcounts, no withstanding their level of qualification) especially sensitive to labour costs and/or qualification? Is the location of value added (vs FDi stock or foreign affiliates) more sensitive of the presence of a market, of existing industries of the same kind, or to the overall business environment of the country?

19. The findings of this initial econometric approach will be then be put into a larger perspective, integrating in particular an analysis of the growing competition by emerging economies for the location of IRA and of the potential impact of the on-going worldwide crisis on internationalisation strategies and location decisions.

1.3 Contents and structure of the report

20. *The first section* of the report shortly presents some stylised facts and analysis regarding the internationalisation trends presently at work in IRA (motives, modalities, recent evolutions and present levels) and the way they affect the development dynamics and prospects of host and home countries economies, especially in the OECD area.

21. Among the major issues studied are: the general feature of the internationalisation trend (why companies set up activities abroad, and under which major modalities? How do they set up and manage international networks in R&D, production and sales?) 2) The measurement of this internationalisation (international investment flows and stocks; degree of companies internationalisation, in terms of production, employment, sales and assets); 3) the analysis of the present structure of the supply (what is the size and role of transnational corporation? How is organised the international division of labour, both at the geographical and companies level)? 4) The description of the major geographical features of international investment (host and home countries).

22. A particular importance is also given to the notion of "attractiveness", in the context of a growing international mobility of productive assets, involving a growing competition between host territories for the location of these assets. The importance of this stake justifies the basis methodological choice of this study, focused on the identification of the major criteria influencing the location decision of MNEs.

23. *The second section* presents the overall research methodology implemented in this study. Its basic aim is to identify the location criteria of foreign controlled activities in IRA, mainly on the basis of an econometric approach. After a general discussion on the major findings and shortcomings of the existing literature on location criteria in IRI, a general research strategy is defined, mainly based on the possibilities opened by the existence of the AFA and FATS data bases.

24. A standard model including all of the possible explanatory variables at the country level (market size, costs, availability of skills, labour costs, R&D intensity, industrial output, etc.) has been set up for this purpose. On this ground, a data base containing various indicators for each of these variables has been built. Tests have been carried out on these data using the econometric panel method, for about 10 various high and medium-high tech industries in services and manufacturing. For each of them, five explained variables have been tested (value added, FDI stocks, number of foreign affiliates, employment, and R&D expenditures under foreign control).

25. *The third section* of the report presents the major results of the econometric study carried out on the AFA and FATS data base, and build upon them a stylised "generic location model", relying upon the basic idea that MNE try to optimise the location of each step of the product value chain in order to internalise the specific competitive advantages of the various potential host countries.

26. A discussion on the limits of this model is then carried out. As a matter of facts, the value of the findings displayed in section three is limited by some methodological weaknesses and shortcomings. Among the most troublesome is the scarcity of data available in some industries, especially in services, which reduce the reliability of some of the econometric results and makes it impossible to carry out some more in-depth analysis, for instance on bilateral international investment data.

27. Another weakness of this work is that it is limited to OECD host countries, which bears two major shortcomings. On the one hand, the growing share of emerging economies for the location of IRA is not explicitly taken into account. On the other hand, result are only based on intra-OECD comparisons, *e.g.* between countries with sometimes very similar structural characteristics. The importance of some location

determinants, such as labour costs and market growth, for which emerging market offer very different conditions, might thus be underestimated.

28. To make up for these weaknesses, a complementary descriptive study has been carried out to assess empirically the pertinence of the standard model on a broader geographical scope than OECD only. This approach relies mainly on the use of *the FDI markets* data base, which provides data on international greenfield investment projects at the world level, *e.g.* including both developed and developing economies (table 2). Findings confirm both the growing share of emerging economies as regards the location of innovation-intensive projects and the specific role of the availability of large pools of manpower with a good quality/efficiency ratio for the location of labour-intensive projects.

29. *The fourth section* tries to assess the consequence of the previous findings in terms of economic policy for OECD countries. As the present crisis might accelerate the restructurings in IRA at the world level, mainly to the benefit of emerging economies, OECD countries must implement policies aimed at preserving their challenged competitive advantage in these industries.

30. The on-going economic and financial crisis seems to bear impacts not on the location criteria themselves, but on the rhythm and dynamics of internationalisation. In particular, the crisis seems to be presently acting as a catalyst for the international restructuring of MNEs, with large cuts made in their less efficient and/or profitable locations and an accelerated adaptation of their cross-border production and distribution networks to take more advantage of the geographic structure of costs, resources and markets.

31. These on-going evolutions can be globally considered more as a threat than as an opportunity for most of the OECD countries, as both market growth and the availability of cheap labour, with already large pools of qualified staff, are major assets of emerging markets. This is true in IRA as well as in other parts of the economy.

32. However, the size of existing markets, the quality of the scientific infrastructure, as well as the efficiency of the overall innovation systems, remains major competitiveness advantages for many OECD countries. In terms of industrial policies, it is of vital importance that these assets be further strengthened in order to confront the risk of a loss of predominance in IRA.

2. INTERNATIONALISATION OF INNOVATION-RELATED ACTIVITIES: WHY, HOW AND WHERE?

33. After presenting some basis facts regarding the internationalisation trend in IRA, this section will discuss the major stakes and opportunities it involves for OECD countries and explain why a good knowledge on location criteria and host country attractiveness is important for policy makers.

2.1 Some stylised facts on internationalisation determinants and trends

2.1.1 A marked trend to internationalisation

34. Internationalisation is not a new reality for industries related to innovation (IRI). Examples abound of companies having subsidiaries abroad, including overseas, as early as the late XIXth century, especially in pharmaceuticals and electric equipments. For instance, Siemens had already established a Japanese subsidiary in 1923. Philips has been operating in Brazil since 1924 and in India since 1930. It had acquired UK electric equipment manufacturer Mullard in 1927, and the German tube manufacturer Valvo in 1932.

35. After WWII, a growing number of manufacturing companies developed their international presence on a large scale. For instance, during the 1950s, Pfizer established subsidiaries in Belgium, Brazil, Canada, Cuba, Iran, Mexico, Panama, Puerto Rico, Turkey and the United Kingdom.

36. This trend has accelerated in the past 25 years, while extending to new activities. While manufacturing IRI have been the first to set up activities abroad on a large scale, services IRI have followed this trend more recently, taking advantages of new opportunities created in the 90's by the opening of new services industries to foreign investors and by privatisations, especially in telecommunications. In practically all IRI, available internationalisation indicators – such as international trade, FDI flows and stocks, technology transfers – have grown more rapidly during this period than their overall activity. This is true both at the country and at the company levels.

37. At the country level, the share of foreign control has grown steadily on most of OECD countries and for most of IRI (see Annex 3 table A3.1).

38. In a symmetric way, at the company level, a significant growth in the geographical spread of MNEs active in IRI has been observed over the recent year. For instance, the UNCTAD's transnationalisation index of most of the largest of these companies has increased markedly since 1993 (Annex 3 figure A3.1).

39. This trend has been fuelled by both pulling and pushing driving forces (UNCTAD, 2007). The main pushing factors are the necessity for companies to access to foreign markets, to rare resources, and to control costs. The main pulling forces are the growing openness of countries around the world to foreign investment and trade, the growing cost/efficiency ratio in long distance transport and telecommunication activities, the privatisation process which took place in many industries (especially telecommunication), and the possibility to implement large-scale cross-border M&As opened both by the liberalisation of financial markets and the development of innovative financing techniques (LBOs…).

40. By the same token, the growing fragmentation of the value chain in many industries has facilitated a growing geographical dispersion of its various components. Coupled to the growing openness of many countries in the world to international investment and trade, this has made possible the implementation by MNEs of cross-border production, distribution, and sometimes innovation networks, as illustrated by the case of the PC and semi-conductors industries (Dedrick and Kraemer, 2008).

41. Not all business functions have internationalised at the same speed however. While distribution, sales and production have been the first to lead the way, R&D and decision-making activities have been slower to locate abroad (Unctad, 2007). An internationalisation trends is however now at work in R&D activities, as shown by the increasing share of foreign-controlled R&D in many industries and OECD countries (Annex 3 Table A3.2).

42. This internationalisation has been carried out through a very large array of modalities. Equity investments probably still remain today the major modes of internationalisation, and will be the major focus of this study. These equity investments can be themselves divided in two categories: merger-acquisitions and greenfield projects. M&A, in particular, have played a key role in the internationalisation process of many IRI, such as pharmaceuticals and electronics, in the past 20 years[5] (see industry examples in Annex 1).

43. Non-equity investments nevertheless also play an important role as internationalisation channels. They include a vast array of modalities such as outsourcing, licensing and various forms of partnerships and strategic alliances. First limited to the production of non-strategic components, outsourcing strategies have in particular gained momentum in the past years, expanding not only to a wider range of manufacturing activities (such as the assembly of PC by Asian companies for the large US PC sellers), but also to various business support functions, notably logistics, customer support services and internal administrative activities such as payrolls, billing and accountancy. A more recent trend is the growing recourse to the outsourcing of some R&D activities, in the context of so-called "open innovation networks" (Sachwald, 2008).

2.1.2 An important role in the globalisation process

44. IRI presently play a key role in the globalisation process. They account for 55.8 %, 56.3 %, and 56.6% of FDI stocks, recent cross-borders M&AS and greenfield projects respectively (table 3).

[5] It should be noted that cross-border M&A have historically played an important role since the beginning in the internationalisation process of some major IRI, especially in the pharmaceutical industry, were the first major operations where implemented *more than one century ago* (annex 1).

Table 3. Contribution of IRI to overall internationalisation indicators

	FDI inward stocks (1)		Cross border M&As, 2006-june 2009 (2)	Greenfield projects 2003-2009 (3)	
Industry	**1990**	**2007**	**Sales**	**Number**	**Jobs**
Chemicals excl. pharmaceuticals	8.9	5.4	10.1	3.2	1.8
Pharmaceuticals				2.5	0.9
Machinery and equipment.	3.3	1.6	2.1	4.6	2.2
- Office and computing machinery	4.6	2.5		1.3	1.8
- Electrical machinery and apparatus				0.6	1.0
- Electronic equipments & components			3.2	6.4	8.4
Precision and medical instruments	0.6	0,6	0.6	0.9	0.4
Motor vehicles and trailers	2.8	2.4		6.0	9.5
Aircrafts and spacecrafts			0.9	1.4	0.9
Post and telecommunications	1.5	5.9	9.1	4.0	2.7
Financial intermediation	19.8	19.4	18.4	8.4	3.7
Computer related activities	7,2	18.6	11.9	10.9	4.4
Research and development					
Other business activities				6.5	2.7
Total innovation related industries	**41.5**	**55.8**	**56.3**	**56.6**	**40.5**

Source: (1) UNCTAD, (2) Thomson Financial; (3) FDI markets. For M&As and FDI, data for C64 include transport and storage. For C71 to C74, data are for all business service.

45. Companies active in IRI also play an important role among the top MNEs in the world. 49.4 % of the top 5000 non-financial companies belong to the IRI industries, accounting for 43 % of their assets. Among the UNCTAD's top 100 non financial TNCs list, 47 belong to IRI (Annex 3 table A3.5).

2.2 New threats and opportunities for OECD economies

2.2.1 A growing importance of emerging economies

46. This internationalisation trend has gone together with a growing competitive pressure on industrialised countries in Western Europe and North America which had historically been the cradle of IRI. As a matter of facts, a number of new competitors have appeared during the past 30 years, both inside and outside OECD, as evidenced by various data on production, international trade or investment.

47. First, while a handful of industrialised countries (USA, Germany, France, the UK and Japan) accounted for the bulk of production and exports on IRI in the late 70's, their share has significantly decreased since then, first to the profit of other West-European countries, then to the profit of emerging countries, notably in Asia. This is especially true for the automotive and ITC manufacturing industries[6] (Macher and Mowery, 2008).

48. This evolution is due to two complementary trends. First, companies form developed countries have relocated since the late 60's a growing part of their production in new economies, initially for cost-cutting reasons, then, and more recently, a order to access to new markets. This was done through two major modalities: on the one hand, through outsourcing to local companies (subcontracting abroad); on the other hand, through direct presence in the country. As a consequence, the share of developing countries in inward FDI stocks has significantly risen over the past twenty years (Annex 3 table A3.3).

6 In other industries such as pharmaceuticals and telecommunication, the domination of large developed countries has not been challenged to the same extend.

49. This trend explains for instance the emergence of the PC assembly activity in Taiwan in the 70's then to China in the late 90's, due to the strategies of US PC sellers, or of the automotive and electronic components manufacturing activities in South-East Asia in the 80's, under the impulse of large Japanese companies (Annex 2). More recently, West European car makers have played an important role in the emergence of a competitive automotive industry in the former socialist countries in Eastern Europe (Sachwald, 2005).

2.2.2 A possible shift in the world balance of industrial power?

50. This growing role of emerging economies in IRI has gained momentum over the recent years, due to three simultaneous evolutions.

51. First, an endogenous network of domestic firms has developed. Some of them (such as Taiwanese ACER) took steps on their role as a subcontractor/OEM for developed countries companies (mainly US and Japanese companies) to further develop more independent activities, Others, such as some Indian pharmaceutical companies directly targeted their final home market, sometimes with products licensed to them by developed countries companies.

52. As a result, a significant share of the largest companies in IRI is now housed in developing countries (Annex 3 table A3.6). This share, however, may differ widely depending on the industries. While developed countries companies remain dominant in pharmaceuticals, biotechs, chemicals and aircrafts, developing Asia now accounts for a significant share of the largest companies in electronics.

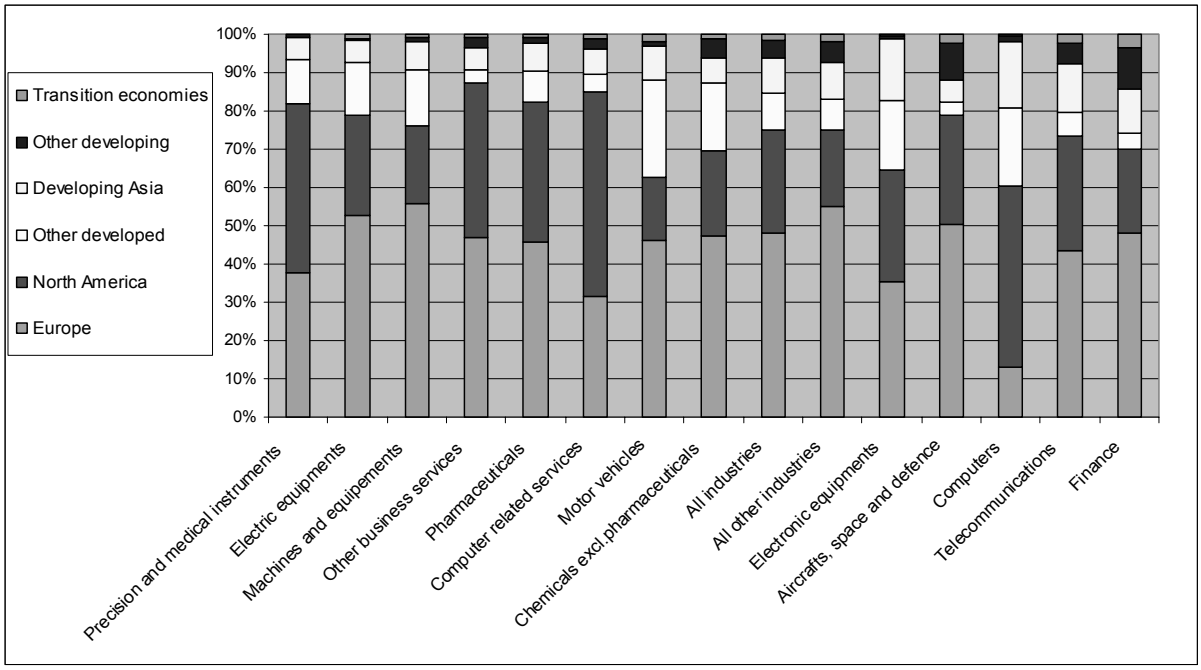
53. These companies from developing countries have themselves begun to implement internationalisation strategies by setting up a growing amount of activities abroad. Samsung begun for instance its rise as a major MNE in the 80’s, through the building of large manufacturing plants in Europe and the US. It became the largest mobile phone marker in the US in 2008. As a consequence, the share in developing countries in outward FDI stocks has substantially increased over the past twenty years (Annex 3 table A3.4). These countries are also substantial players in terms of outward greenfield investments, even if companies from developed countries still remain dominant in this regard (figure 2).

54. Second, international companies in IRI have dramatically increased their direct investments on emerging markets (especially India and China), which now appear in particular as a major destination for greenfield projects (Annex 3 figure A3.1). Various recent surveys (JBIC, 2008) suggest, than albeit labour cost remain an important motive for investing in these region, access to markets (especially in China) plays a growing role in this regard.

55. Third, some emerging countries, especially in developing Asia, are engaged in a process of technological take off. While they had initially based (with the notable exception of India) their economic expansion on the development on low-tech, labour intensive manufacturing (including at some step of the IRI value chain), they are turning to more innovation-intensive activities. They can rely for this on three major sources of competitive advantages: large pools of qualified engineers and technicians, the importance of both their industrial and customer base, and a rapidly expanding scientific and academic infrastructure.

Figure 1. Greenfield projects by industry and home region, 2003-July 2009

(number of projects)



Source: OCO Consulting, FDi Markets

56. In consequence, they account for a growing, even if still modest, share of business R&D worldwide (UNCTAD, 2005). India is for instance is very active in software development, while Taiwan plays an important role in the development of electronic components and platforms (Arora and al., 2008). These activities are being carried out either by domestic companies or by local subsidiaries of foreign MNEs, which have significantly increased their R&D investment in emerging countries (especially in Asia) over the past years (Annex 3 figure A3.3).

57. This increase, however, remains mainly focused on downstream R&D (clinical tests, adaptation and support activities, etc.), while developed countries has so far remained dominant at the upstream stages (fundamental research). By the same token , this last group of countries remains home to the overwhelming share of R&D expenditures and patents granted to residents worldwide and also of R&D investment abroad (Annex 3 figure A3.4).

2.3 Understanding MNEs location criteria, a key issue for policy makers

58. For OECD countries, the trends described above carry out four major consequences, most of which can be considered as threats rather than opportunities:

59. *First,* a new kind of competition between countries is gaining momentum, beyond the more traditional one in terms of market share for final products. This new kind of competition regards the location of their production capabilities and business support function by MNEs, which select for each project the most attractive one, after a comparison of the relative strengths and weaknesses of the various territories in competition (Hatem, 2008).

60. *Second,* a growing number of countries are involved in this competition for the attraction of international investment in IRI, inside as well as outside OECD. Emerging countries in Asia, and, to a

lesser extend, former planed economies in Eastern Europe, have performed quite well to this regard in the most recent years. The existence of low cost resources and fast growing market has led many MNEs to locate there, rather than in traditional industrialised countries, their large-scale manufacturing activities.

61. *Third,* emerging economies are presently engaged in a very quick catch up process in terms of innovation capabilities. This in turn enhance their attractiveness for FDI in innovation-intensive projects (such as products design, clinical research centres, software development, tests and research support centres, high-tech manufacturing facilities, etc.). In consequence, the major industrialised countries are confronted to the competition of these new comers not only at the low-end, low-technology side of the value chain, but also for more technology or knowledge-intensive components.

62. As developed countries are confronted too much sharper difficulties in low and medium low technology industry, where the competition of low labour cost countries has had dramatic consequences on the local industries, it is absolutely vital for them to preserve their already dwindling competitive advantages in innovation-intensive activities. For this, they need to implement policies aimed at improving the local environment for these businesses.

63. In order to do this, however, they must have a clear view on the needs and request and investors. As most of them are MNEs, which have the choice between various host countries for the location of most of their activities, this question is directly related to that of the criteria used by investors to set up the various components of their international businesses. This is the question will be addressed the main focus of the rest of this study.

3. LOCATION CRITERIA: A STRATEGY TO EXTEND THE EXISTING KNOWLEDGE

64. A survey of literature, implemented at the request of the OECD, has pointed out the shortcoming of the existing knowledge on location criteria at the industry level. Following the recommendations of this survey, a study has been carried out on the basis of the AFA and FATS data base, which provide detailed insight on the foreign presence in OECD countries. After a general presentation of the objective and methodology of this study, this section introduces the econometrical model which has been tested, as well as the data base build on this purpose.

3.1 Main results of the existing literature

65. A literature survey on location criteria has been implemented in 2008 at the request of OECD (Hatem and Py, 2008a). Its main findings are that, despite the existence of interesting results, there is still a need or additional studies at the industry level, using new types of data describing the level of foreign presence in various host countries.

66. *A significant amount of literature* has already analysed the internationalisation trends and location determinants in activities related to innovation. In addition to scientific works by academics, a large share of the available literature stems from studies carried out by consulting companies and public reports. Studies are especially numerous regarding internationalisation motives and location determinants for R&D activities, and to a lesser extend, headquarters. Analyses are scarcer regarding location determinants in specific high-tech industries.

67. *Regarding the motives for R&D internationalisation*, two major driving forces have traditionally been identified. Firms invest abroad either *i*) to adapt their product and process to foreign consumer's requirements or *ii*) to augment their specific capabilities by tapping into foreign knowledge and techniques. The recent expansion by MNEs of their international R&D activities outside the Triad, particularly in emerging Asian countries, suggests that cost and availability of large pools of scientific personnel are becoming important motives for R&D internationalisation as well.

68. *Regarding location determinants in R&D activities,* the most frequently mentioned general factors are market size, agglomeration forces, access to scientific and technical capabilities, and, increasingly, cost considerations, while there is more uncertainty about the impact of intellectual property right regimes. Beyond these general determinants, location behaviours differ depending on the nature of the activities carried out abroad. Adaptive R&D facilities are more prone to locate closer to the final market, while the location of innovative R&D is driven by proximity to poles of technical and scientific excellence. Besides, while firms are prone to locate their adaptive R&D close to their existing production facilities, this effect is much more limited in the case of innovative R&D activities.

69. *High-tech industries* as a whole are particularly sensitive to the availability of high- quality resources (skilled labour, scientific infrastructure, etc.), while factors relative to labour cost considerations appear less influential than in the average of other industries (see examples in table 4). Studies on location determinants in high-tech activities, however, remain too heterogeneous and incomplete to allow us to point to definitive conclusions, especially at a detailed industry level.

Table 4. Importance of location factors, by industry, 2009-2011

(Per cent of companies' responses to an UNCTAD survey for each industry)

Sector/industry	Presence of suppliers and partners	Follow your competitors	Availability of skilled labour and talents	Cheap labour	Size of local market	Access to international/ regional market	Growth of market	Access to natural resources	Access to capital market (finance)	Government effectiveness	Incentives	Quality of infrastructure	Stable and business-friendly environment
Primary	**8.8**	**2.9**	**9.4**	**4.1**	**10.5**	**7.6**	**9.9**	**19.3**	**1.8**	**7.0**	**0.6**	**7.0**	**11.1**
Manufacturing	**10.1**	**5.0**	**8.1**	**6.5**	**17.5**	**10.0**	**15.8**	**3.4**	**2.4**	**4.0**	**2.9**	**6.1**	**8.1**
Chemicals and chemical products[a]	9.5	2.9	5.1	5.5	18.2	12.4	18.6	6.2	0.7	4.4	1.5	5.1	9.9
Electrical and electronic equipment	10.9	6.3	8.9	7.6	17.1	10.9	19.1	1.0	2.0	2.6	2.6	5.3	5.9
Food, beverages and tobacco	12.6	7.3	6.6	4.6	18.5	9.9	16.6	0.7	6.6	2.6	2.6	4.6	6.6
Motor vehicles and transportation equipment	9.8	7.0	6.0	7.4	17.7	8.8	12.6	2.8	2.8	3.7	6.5	7.4	7.4
Other heavy industry[b]	9.5	2.5	6.9	7.9	16.7	8.8	13.9	8.8	2.5	5.4	0.9	6.3	9.8
Other manufacturing	8.8	8.8	8.8	7.7	17.6	6.6	6.6	-	4.4	8.8	3.3	7.7	11.0
Pharmaceuticals	9.6	9.6	9.6	2.7	17.8	15.1	16.4	-	2.7	6.8	1.4	4.1	4.1
Professional equipment goods	10.2	3.3	13.5	5.8	17.5	8.8	16.8	1.1	0.7	2.2	4.4	7.7	8.0
Services	**9.5**	**3.7**	**8.6**	**3.7**	**17.5**	**9.2**	**17.5**	**1.5**	**5.1**	**5.8**	**1.8**	**6.8**	**9.2**
Business services	10.3	2.6	12.1	10.3	15.5	12.9	16.4	-	2.6	4.3	3.4	4.3	5.2
Electricity, gas and water	11.9	-	5.2	2.2	13.3	5.2	11.1	5.9	8.9	8.1	-	13.3	14.8
Other services	11.6	1.4	10.9	2.2	19.6	6.5	19.6	0.7	4.3	8.7	4.3	2.2	8.0
Trade	11.7	8.1	9.0	2.7	17.1	9.9	19.8	0.9	3.6	3.6	1.8	5.4	6.3
Telecommunications	5.4	2.7	6.8	2.7	25.7	10.8	27.0	-	6.8	4.1	-	2.7	5.4
Transportation	1.3	10.4	6.5	1.3	16.9	13.0	14.3	-	3.9	3.9	-	13.0	15.6
Total	**9.9**	**4.5**	**8.3**	**5.6**	**17.1**	**9.6**	**15.9**	**4.0**	**3.0**	**4.7**	**2.5**	**6.3**	**8.6**

Source: UNCTAD, 2009b.

[a] Excludes pharmaceuticals.

[b] Includes metal and metal products, non-metallic mineral products, and wood and wood products.

70. One of the main recommendations of the survey is thus to make use of the OECD's AFA and FATS data bases in order to carry out additional studies on location criteria at a detailed industry level. This approach would bear five major advantages.

71. *First,* the use of data on the level of foreign controlled activities in host countries would probably give a more accurate view on the real magnitude of MNEs presence abroad than most of the data used in this kind of study. For instance FDI flows and stocks have only an indirect an ambiguous relation with the real level of foreign activity in a given country, due to the fact that they include many other capital flows than those directly related to gross fixed capital formation. Data on individual investment projects or foreign affiliates may involve, depending on the cases, problems of weighting – a "small" project being given the same importance as a "big" one – or of data quality control – especially the case of so-called "announced" projects, the implementation of which being not always checked properly afterwards.

72. *Second,* AFA and FATS data bases provide homogenous data for all OECD countries at a detailed industry level, allowing the completion of studies bearing both the advantages of a large scope (all industries at the OECD level) and of detailed comparisons between industries and countries (see also box 1)

73. *Third,* those data bases offer quite long time series (from 1985 onwards), thus allowing the tracking of changes in location patterns over time through the use of econometric panel approaches.

74. *Fourth,* the AFA and FATS data base use standard nomenclatures and statistical concepts. This simplifies the use of other data bases set up by intergovernmental organisations such as OECD or the European Union to select explanatory variable at the detailed industry level. In contrast, data bases on international projects set up by consultants such as OCO as Ernst and young rely upon specific nomenclatures, with is sometimes hardly compatible with standard ones such as ISIC.

75. *Fifth,* the AFA and FATS data base aim at providing indicators for a large range of foreign controlled activities for each industries and each country: employment, value added, production, R&D

expenditures, etc. This allows testing the existence of specific location criteria for each of these indicators. For instance, there are obvious reasons to believe than there might be significant differences between the criteria explaining, for a given industry, the location of foreign employment (in terms of headcounts, all qualifications mixed) and the level of R&D expenditures. Testing this hypothesis will be one of the main purposes of our study.

76. In order to take advantage of theses potentially, a specific research methodology has been built, and will be presented in the following section.

Box 1. Major findings on the internationalisation of IRA (AFA and FATS data bases)

a) High Tech

Goods

• The high-tech production of foreign affiliates in the EU-15 is proportionate to the total manufacturing output of foreign affiliates. However, it is disproportionately high in the United States and Japan.

• The Central European countries and Canada attract less in the way of high-tech activities from foreign multinationals than the United States, Japan or the EU-15 as a whole.

• Within the EU-15, however, there are some major discrepancies. In 2003, high-tech sales percentage of the aggregate turnover of foreign-controlled affiliates was highest in Ireland and lowest in Poland.

• Foreign affiliates' sales in electronics, pharmaceuticals and scientific instruments were much greater in the United States than in other OECD countries.

Services

• Sales of other business services in the OECD area as a whole are twice as high as sales of computer services, while the figure for R&D is one-tenth that for computer services.

• The United Kingdom is the most attractive country for computer services and R&D (from outsourcing).

• In the case of other business services and in particular that of finance and insurance, foreign affiliates are far more predominant in the United States than they are in other countries.

Research and development

• The United States and Japan appear overall to be the most attractive countries for the R&D, and more specifically high-tech, activity of multinational firms.

• The R&D activity of foreign affiliates in the OECD area is mainly concentrated in three sectors, which account for some 70% of all industrial R&D, namely pharmaceuticals, motor vehicles and electronics.

• Germany is the primary pole of attraction for manufacturing R&D in Europe, while the United Kingdom is more successful in attracting knowledge-intensive services (computer services, R&D, financial services).

Source: OECD, 2007

3.2 Presentation of the research methodology

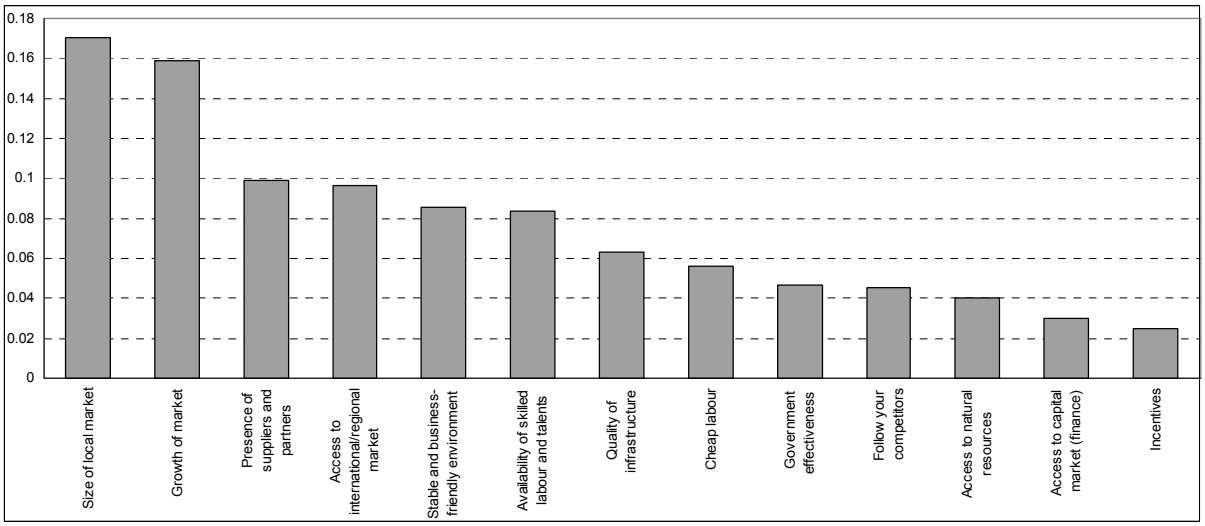
77. The research methodology used in this study is of empirical rather than theoretical nature. First of all, a standard explanatory model is designed on the basis of the finding of the existing literature. A data base is then built in order to provide various proxies for the conceptual variable represented in the standard model. Various combinations of these different proxies are then econometrically tested for each of the explained variables, respecting the structure of the standard model. On the basis of the results, the final

explanatory variables are selected, and some components of the standard model are dropped if none of the proxies for this component is considered significant.

78. The components of the standard model are directly retrieved from the findings of the existing literature (see UNCTAD, 2009a, page 23 and figure 2). Three major motives for investing in a given country are generally identified: access to market (market-seeking or MS), access to resources (resources-seeking or RS), access to low costs (efficiency-seeking or ES). A large set of literature also insist on the existence of specific agglomeration effects (AG). In addition, the quality of the business environment (BE) and the openness of the country to foreign investment (OC) are also considered as favourable factors for the location of investment.

Figure 2. Major location factor, all industries, by order of importance, 2009

(Per cent of companies' responses to an UNCTAD survey



Source: UNCTAD, 2009b

79. More precisely, the specific importance of various location criteria is as follow:

- **Market.** Proximity to the customer is in general an important location determinant in IRA at various stages of the product value chain (figure 3. At the upstream stage, it meets the need of a strong interaction between the supplier and its customer for the conception of the product. In semi conductors, for instance, due among others to the wide variety of applications, a close cooperation between developer of chip (components) and of systems is necessary in many cases (Macher, 2008)[7]. At a more downstream stage, the location of production facilities close to the final market also bears many advantages (lower transport costs, better reliability of the supply chain, by-passing tariff and non-tariff barriers, better adaptation of the product to local regulations or customers' request, etc.). These factors explain in particular why pharmaceuticals companies tend to divide the worldwide production of each of their major products between various manufacturing sites located on different continents, close to each of their major markets. However, in some industries - especially electronics and computers – the location of mass production facilities may be more sensitive to the availability of low cost and efficient labour force than to the proximity to market.

7 The same is true for software products (Arora and al., 2008)

- **Human resources (quality).** This location criteria play an important role, especially for the upstream part of the product development process (R&D, design, pilot production…). This explains in particular why there has been so far only limited off shoring in upstream R&D activities motivated by pure cost-related issues[8]. This criteria is also important, but to a minor extend, for other segments of the value chain, such as the most technologically advanced production facilities.
- **Human resources (costs).** In some IRA, the manufacturing of standard/mature components and assembled products (notably micro-computer) can be very cost-sensitive and thus prone to be located in cheap-labour countries. A large share of the world production of notebooks is for instance carried out in the Shanghai area, in many cases by Taiwanese-owned plants (Dedrick and Kraemer, 2008). Production related activities in the flat panel display industry, which originated in the US, quickly migrated to Japan, followed by Korea and Taiwan, and new are expanding in China for cost reasons (Hart, 2008). Some development and R&D support activities can also be sensitive to the existence of large pool and qualified and cheap labour. This is one of the reasons (together with access to markets) of the relocation of part of their development activities to developing Asia by US firm engaged in flat panel display components manufacturing. There is also an increasing (albeit limited) trend of OECD companies to relocate R&D for cost-effectiveness reasons in engineering, software, industrial design, and projects management.
- **Co-location effects** Development and application centres are frequently located close to production facilities in some industries. For instance, in the flat panel display industry, innovation activity has tended to follow production investment in the industry because of high demands for process innovation (Hart, 2008). Production can also attract some last-phase development activities (as is presently the case in China), such as production engineering, sustaining engineering, pilot production, testing, design review, prototype processes. But the dominant trend is the fragmentation of the value chain, allowing a separate location of each of its components into different sites. For instance, the value chain in the PC industry is quite fragmented worldwide (Dedrick and Kraemer, 2008)[9].
- **Presence of suppliers and industrial agglomeration effects.** The overall quality of the industrial environment is an important location criteria for manufacturing activities in most of the IRA. This includes the existence of a large labour market, the presence of skills, activities and infrastructures necessary to the completion of the activity, and of a high-level technical environment (including the presence of suppliers, competitors, and potential partners). This leads to the existence of strong agglomeration and specialisation effects. Examples are the Glenn Valley for semi-conductors manufacturing in Scotland, the Grenoble area for opto-electronics in France, the Penang peninsula for the manufacturing of electronic components in Malaysia, and the Shanghai area for notebooks manufacturing.
- **Scientific infrastructures.** The intrinsic quality of public and academic research institution, but also the potential for partnership that they may offer to companies, are important overall for the location of fundamental and upstream research. For instance, there is an important clustering

8 Examples however already exist in downstream R&D and this trend could get momentum in the coming years, as already mentioned in section 1.

9 It should also be mentioned that a large share of production abroad, especially in electronics and computers, is not made through FDI but outsourced to contract manufacturers or ODMs, sometimes located very far away from their final customer.

effect for the location of R&D in the semi-conductors industry (proximity to universities) in such areas as the Silicon Valley, the Boston 101 road, and Austin (Texas).

- **Other infrastructures and public policies.** General infrastructure may play a role in particular for the location of high-tech production capabilities: quality of water, power, logistics… Public policies regarding research, education, innovation, the development of large ITC infrastructure (Web, broadband, telecommunication) may play in particular an important role to stimulate innovation in the related industries. A more advanced Internet infrastructure development in the US was for instance a major source of competitiveness for US firms based in internet- related products and services. The opposite was true for broad band and mobile industries, for which Asia has gained leadership over the US due to a better endowment in telecommunication infrastructures (Macher and Mowery, 2008).
- **Administrative and legal environment.** Innovation-intensive industries are quite sensitive to various aspects of these matters: 1) as being highly dependent on patterns, they give much importance to IPR protection issues; 2) as they are very capital intensive and need the construction of very specialised buildings[10], construction permits are a major issue to many of them (ex: pharmaceuticals, chips, chemicals).
- **Incentives and taxes.** Incentives are not a very important location determinant in general, but: 1) companies may be sensitive to the existence of favourable tax rules on R&D; 2) the overall level of fiscal pressures is always an important determinant of costs; 3) incentives may play an important role in the final stages of the decision-making process for the location of international activities.
- **Capital market.** Venture capital may be an important factor for the development of some innovative products, but this regards much more endogenous development than FDI. The existence of an active capital market in a country is thus not a major direct determinant of FDI in innovation - intensive industries.
- **Openness to FDI.** They are a prerequisite for all activities, but not especially for ITCs.
- **Natural resources.** They are not a very important location determinant in most of IRA.

80. On the basis to this general approach, various presentations of the explained variable could be considered. The most interesting one, at first sight, would be to explain the share of a given country in total foreign presence in the OECD ($FP_{ij}(t)/\sum FP_i(t)$) by its relative competitive advantages, compared to OECD average. The basic structural formulation would then be:

(1) FPij (t)/∑FPi (t) = F(MSij(t)/∑MSi(t), RSij(t)/M_RSi(t), ESij(t)/M_ESi(t), BEij(t)/M_BEi(t), OCij(t)/M_OCi(t))

Where:

- FP is the level of foreign presence,
- MS the indicator of market size,
- RS the indicator of quality of resources,
- ES the indicator of costs level,
- BE the indicator of quality of business environment,

[10] Often submitted to very strict regulations regarding safety and environmental protection.

- OC the indicator of openness to international investment[11].

81. The major interest of this formulation is that it fits well to the notion of "market share" intimately related to the concept of attractiveness. However, this approach also bear three major weakenesses:1) it does explain neither the overall growth or the actual level of the global foreign activities of MNEs in a given industry; 2) it is limited to OECD countries and does not explain (or even keeps track of) of the overall lose of market share by this group of countries to the benefit of emerging economies; 3) it supposes that data on foreign presence are available for all OECD countries for all years. As this last hypothesis is far from being true, it is impossible in practice to rate a reliable $\sum FP_i$ (t) variable (*e.g.* sum of foreign presence on all OECD countries for a given industry and a given year). The $FP_{ij}(t)/\sum FP_i(t)$ ratio (measuring the market share of country j in the total foreign presence in industry i for OECD countries) can thus not be measured in a proper way.

82. For these reasons, we prefer to try to explain the absolute value of the presence of foreign activities for each OECD in a given industry. The structural equation is then:

(2) FPij (t) = F(MSij (t), RS ij(t), ESij(t), BE ij(t), AGij(t), OC ij(t))

83. Where the variables have the same meaning than in equation (1). For each of these variables, $X_{ij}(j)$ represents the value of the given variable X (resp. FP, MS, ES, OC, etc.) for industry i in country j, year t.

84. Using the log form as usually done the literature[12], we find as a testable functional form:

(3) log(FPij (t)) = log(MSij (t))+log(RS ij(t))+log(ESij(t))+ log(BEij (t))+log(AGij(t))+log(OCij(t)) +Cj

85. Where the variables have the same meanings than in equations (1) and (2). The constant term C takes different value depending on countries (due to the use of panel econometric with fixed effect) in order to reflect country specificities not taken into account in the generic formulation (2). This generic functional form will thus be the one tested in our study.

86. The tests were carried out for three different explained variables: 1) foreign controlled value added; 2) foreign controlled employment and 3) foreign controlled R&D expenditures[13]. Each of these three approaches is aimed at analysing location determinants at different steps of the value chain of for different aspects of the companies' activities. In particular, the second series of test sheds light on specific location determinant for the most labour intensive activities, while the third one will help to understand better how companies locate their R&D activities abroad.

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11 In this formulation, indices have to be read as follows: for each of the preceding variables, $X_{ij}(t)$ represents the value of the given variable X (resp. FP, MS, ES, OC, etc.) for industry i in country j, year t, $\sum X_i(t)$ represents the value of the given variable X (resp. FP, MS, ES, OC, etc.) for industry i for all OECD countries, year t, and $M\_X_i(t)$ represent the average value of the given variable X (resp. FP, MS, ES, OC, etc.) for industry i in all OECD countries, year t.

12 We drop in this empirical approach the theoretical and mathematical developments justifying this very common formulation. To get an idea of these standard developments, see (Hatem and Py, 2008b).

13 Two additional series of tests were finally added for the two following explained variables: FDI stocks and the number of foreign subsidiaries.

87. It was chosen to carry out these tests separately for each industry, rather than implementing a double-dimension panel study by industry and country. One of the major reasons of this choice was the desire to identify a specific set of values (including eventually a nil value) for the potential explanatory variables in each industry in order to allow cross-industry comparisons.

88. The tests were carried out only for the IRI mentioned in table 1, and thus not implemented for low and medium-low tech industries. This choice is explained by: 1) the specific focus of the study on IRI; 2) the very large amount of work necessary to carry out tests in all other industries. It however does not allow the identification of industry specific location criteria for IRI as compared other industries, thus reducing the overall interest of the study. To remedy this, tests have been carried systematically on the overall manufacturing sector, in order to offer global elements of comparison.

89. Another choice was not to introduce, at that step, lagged or moving average variables, not withstanding the fact that the actual level of foreign activities in a given country is the result of past location decisions, made on the basis on past value of the explanatory variables. One of the major reasons for this is that, due to the existence of many missing data in the time series used, this would have dramatically reduced the number of complete available observations, thus impacting negatively the quality of the econometrical tests.

90. Finally, as we shall see later, some of the explanatory variables (for instance those measuring the agglomeration effects or the market size) are described in the data base as industry-specific, while others (for instance those relating to the business environment or the overall degree of openness of the economy to foreign investment) have the same value whatever the industry. There are three reasons for this last choice: 1) the fact that some of these variables (*e.g.* business environment) are of general nature and do not refer to an industry in particular; 2) the fact that, even in the case of variables which might be considered as industry-specific (for instance labour costs), the inter-country variance of average value (all industries included) explains much of the inter-country variance at the industry level, thus reducing the interest to use industry-specific data[14]; 3) the lack of data at the industry level[15]

3.3 Building the model and the data base

91. As mentioned earlier, three major explained variables have been selected (table 5): foreign controlled value added, foreign controlled employment and foreign controlled R&D expenditures[16]. While these variables are generally expressed in national currency in the AFA and FATS data base, we converted them in current US$ for the sake of the econometric tests.

92. Regarding indicators of market-seeking behaviours, two major explanatory variables have been tested: the national GDP and the regional accessible market (measured by potential GDP[17]).

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14 In clearer terms: most of the difference of wage levels in electronics between Portugal and Germany is explained by the overall difference in average wage levels between these two countries. Factors specific to the Portuguese or German electronic industries only play a limited role to explain this difference.

15 In the specific case of patents, for instance, detailed nomenclatures by technological categories are not always easily comparable with industry nomenclatures (ISIC codes).

16 Two additional series of tests were carried out on FDI stocks and the number of foreign affiliates.

17 For a given country, the potential GDP is defined, using the Harris approach, as the sum of all markets in the world, weighted by their distance to the country considered. The distance indicator used is CEPII's distw (distance between the major cities of the countries weighted by their population. In the study, it was however decided to put a cap on the distance of the country to itself, in order to avoid unexpected effect such as having the USA accounting for more than 50% of Australia's potential GDP, or Austria's potential

Table 5. Main variables used in the econometric study

Name	Contents	Source
$VAE_{i,j}(t)$	Foreign controlled value added in industry I for country j, year t, current value in national currency	OECD (AFA and FAST data bases)
$EMPE_{i,j}(t)$	Foreign controlled employment in industry I for country j, year t, current value in national currency	OECD (AFA and FAST data bases)
$RDE_{i,j}(t)$	Foreign controlled R&D expenditures in industry i for country j, year t, current value in national currency	OECD (AFA and FAST data bases)
$FDI_{i,j}(t)$	Foreign direct investment in industry i for country j, year t, current value in national currency	OECD (AFA and FAST data bases)
$NUMBE_{i,j}(t)$	Foreign controlled subsidiaries in industry i for country j, year t number of units	OECD (AFA and FAST data bases)
$VA_{i,j}(t)$	Value added in industry i for country j, year t, current value in national currency	OECD (STAN data base)
$EMP_{i,j}(t)$	Employment in industry i for country j, year t, current value in national currency	OECD (STAN data base)
$RD_{i,j}(t)$	Total domestic R&D expenditures in industry I, country j, year t, current value in national currency	OECD (AFA and FAST data base)
$GDP_i(t)$	GDP in country j, year t, current value in national currency	OECD
$FRAT_j(t)$	Total FDI inward stocks/GDP ratio, country j, year t	OECD,UNCTAD
$PIBPOT_j(t)$	Potential GDP, current US$ value, country j, year t (see calculation method in the main text)	Author's calculation, based on OECD and CEPII data
$TXCH_i(t)$	Exchange rate of the national currency against US$, country j, year t	
$BREV_j(t)$	Number of patents granted to residents in country j, year t	OECD (STAN data base)
$RD_j(t)$	Total R&D expenditures in the business sector in country j, year t, current value in national currency	OECD (STAN data base)
$NUMB_{i,j}(t)$	Total number of companies in industry i for country j, year t	OECD (STAN data base)
$STOCK_{i,j}(t)$	Fixed capital stocks in industry i for country j, year t, current value in national currency	OECD (national accounts
$INDSSAL_j(t)$	Hourly wage compensation costs, current US$ value, country j, year t	US Bureau of Labor Statistics
$HQ_j(t)$	Share of highly qualified workers in the total working population in the business sector, country j, year t	U-KLEMS data base
$MQ_j(t)$	Share of medium qualified workers in the total working population in the business sector, country j, year t	U-KLEMS data base
EDUCj(t)	Capability of the local workforce to meet the needs of the business sector, country j, year t. (response to an opinion survey among local business executives)	IMD, Global competitiveness Yearbook data base
ENVj(t)	Government efficiency ranking index , country j, year t.(composite index of around 15 quantitative and qualitative variables). The higher the index, the lower the government efficiency.	IMD, Global competitiveness Yearbook data base

93. Regarding indicators of resource-seeking behaviour, the following variables have been tested: 1) total global R&D expenditures, both at the global and industry levels; 2) total number of patents filled in by country's residents; 3) share of highly and medium skilled worker in the total working population in the business sector; 4) judgement of the country's business executives on the capability of the local workforce to meet the needs of the business sector.

94. Regarding indicators of efficiency-seeking behaviours, the only variable tested has been the hourly labour compensation costs for workers in the manufacturing sector, expressed in current US$ terms (source: US Bureau of Labor Statistics). Data were also available at the industry level, but have not been tested as the time series were quite short (since 1997) thus reducing dramatically the already limited number of observations available for econometric tests.

95. Regarding indicators of business environment and openness to foreign presence, two variables have been tested: 1) the overall index of government efficiency, rated yearly by IMD on the basis of

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GDP equivalent to the US one, as would be the case if the usual way of rating Harris' potential GDP had been followed. The cap chosen was the auto-distance of the smallest OECD country (*e.g.* Luxembourg) according to the Distw variable (Mayer, 2008). This allows, in clear, to give more weight to the country's own GDP in the rating of its potential GDP than would be the case in the usual "Harris" approach, especially in the case of very large countries such as the US or Australia.

around 15 indicators, for the preparation of the Global Competitiveness Report; 2) the ratio of FDI inward stocks to GDP.

96. Regarding indicators of agglomeration effects and country's specific capabilities in the concerned activities, various specific explanatory variables have been chosen depending on the explained variable, *e.g*: domestic value added in industry i (either in absolute term or as a share of total GDP) in the equation explaining the location of foreign-controlled value added in industry i; total gross capital stocks in industry i in the equation explaining the location of FDI stocks in industry i; the number of domestic firms in industry i in the equation explaining the number of foreign affiliates in industry i; and various variables referring to domestic R&D expenditures (either global or in industry i) in the equation explaining the location of foreign-controlled R&D expenditures.

97. All variables originally expressed in national currency have been converted in current US dollars using the $TXCH_j(t)$ variable (table 5). *In consequence, all variables used in the equation displayed below are expressed in current US dollars terms.*

98. Tests have been carried out using the e-views software. The validity of the panel specification – as compared to ordinary least squares - has been systematically tested, with positive results in practically all cases. All the tests presented in this paper are thus based on the panel approach with fixed effects for the constant variables, using white period standard errors & covariance, with no d.f. correction.

4. THE RESULTS: HOW COMPANIES OPTIMISE THE GEOGRAPHICAL LOCATION OF THEIR VALUE CHAIN?

99. Results of the econometric study point out the existence of different location criteria depending not only on industry, but also on the nature of the business function. This result suggests the existence of a standard location behaviour by MNEs, which try to optimise the location of the various stages of their value chain in order to take advantage of the specific advantages of each host country or region for each kind of activities. This conclusion seems to be comforted by the examination of other sources of data at the world level.

4.1 Specific location criteria depending on the nature of activity

100. The standard model (3) has been tested for three major explained variables (value added, employment and R&D expenditures), plus two additional ones in order to comfort these findings (FDI stocks and number of foreign affiliates). The results show that, beyond some common determinants (notably the access to market), the location of R&D expenditures is more sensitive to the overall R&D propensity of the host country, while the location of employment (in terms of headcounts) is significantly influenced by labour costs.

101. Regarding industries, results differ widely depending on the activities as could be expected. It should however be already mentioned that the low number of observations weakens the reliability of the results obtained for some activities, especially aircrafts, financial services and telecommunications.

4.1.1 Foreign-controlled value added

102. Regarding the location of value added, various empirical tests have finally led to select the following formulation as the one giving the most satisfactory results (table 6):

$$\textbf{(4) } \log(VAE_{i,j}(t)) = F(\log(PIBPOT_j(t)), \log(FRAT_j(t)), \log(VA_{i,j}(t)/GDP_{i,j}(t)), C)$$

(F = linear equation, panel regression with fixed effects)[18]

103. It should be noted in particular that all reference to production costs have been dropped, as wages levels have not been identified as a significant location criteria in any of the formulation tested. The "government efficiency index" variable appeared with the expected sign in most of the cases (see below) but was not very significant, and was thus dropped from our “standard model”. As for the "labour quality" variables, they were found to be quite significant in some formulation (see below), but turned out to be insignificant each time the VA or VA/GDP variables were introduced, the latter probably capturing most of the explanatory power of the former one.

104. One of the most reliable findings is the very strong explanatory power of the "access to market" variable, which turns out to be significant for a very large array of specifications (including or not labour costs and qualifications, for instance). This is true whatever the variable used to measure the market

[18] For the definition of the variables mentioned in equation (4), please refer to table 5.

(national GDP[19] or potential GDP). In other terms, foreign investors are clearly attracted by the market prospects, whatever the industry considered.

105. Another important finding is the importance of "agglomeration" and/or "country specialisation" effects. All things being equal, investors in IRI are more prone to create value added in countries where there is already a high level of activity and/or which are very specialised in their industry. As for the previous explanatory variables, this result seems to be quite resilient to the overall formulation of the econometric equation as well as to the choice of the variable used to measure the agglomeration effect[20]. As mentioned earlier, this variable probably captures some of the potential explanatory effect of the "quality of resources" and "quality of public governance" variables. This result is very interesting, but also somewhat frustrating as it reveals to be rather tautological (as nothing in our equation explains why the domestic industry itself has reached its present level).

Table 6. Determinants of foreign controlled value added location in OECD countries

(standard model)

	VA_i/GDP	PIBPOT	FRAT	C	OBS.	LK FCT	ADJ R2
VAE_ C15T37	1.2 (0.5)**	1.6 (0.3)***	0.4 (0.1)***	- 29.0 (10.0)**	168	14.6	0.97
VAE_ C24-2423	1.8 (0.2)***	0.7 (0.5)	0.3 (0.1)***	- 21.6 (8.6)***	104	5.1	0.96
VAE_ 2423	1.9 (0.5)***	0.6 (0.6)	1.0 (0.4)**	- 20.3 (7.7)***	109	- 86.3	0.89
VAE_ C29T33	1.0 (0.4)**	1.3 (0.2)***	0.1 (0.1)	- 21.8 (8.1)***	73	32.2	0.98
VAE_C29	0.3 (0.3)*	1.9 (0.4)**	-0.2 (0.5)	-23.2 (4.8)***	119	-38.1	0.93
VAE_ C30T33	0.3 (0.2)*	0.9 (0.2)***	0.3 (0.2)*	-9.8 (4.4)**	85	12.1	0.96
VAE_ C30	- 0.3 (0.8)	- 0.2 (1.2)	- 0.5 (0.2)**	13.7 (21.6)	95	-138.2	0.64
VAE_ C31	0.2 (0.6)	0.9 (0.7)	0.4 (0.4)	- 9.4 (12.9)	135	- 96.9	0.83
VAE _C32	0.8 (0.3)***	1.1 (0.5)**	0.2 (0.3)	- 17.1 (9.2)*	126	- 73.7	0.90
VAE_ C33	0.7 (0.3)***	2.1 (0.3)***	0.3 (0.1)**	- 31.2 (5.6)***	131	- 8.7	0.97
VAE_ C34	0.5 (0.4)	0.6 (0.9)	1.6 (05)***	-11.6 (15.7)	116	- 100.4	0.89
VAE_ C353	0.4 (0.9)	1.6 (1.4)	0.8 (1.0)	- 23.4 (15.4)	32	- 36.1	0.84
VAE_ C64	- 0.2 (1.1)	1.8 (0.9)**	1.7 (1.0)*	- 27.5 (8.6)***	40	- 8.2	0.81
VAE_ C65C67	0.6 (0.0)***	2.5 (0.0)***	1.8 (0.0)***	- 34.6 (0.0)***	11	43.0	0.95
VAE_ C72	1.6 (0.2)***	1.6 (0.2)***	0.4 (0.2)	- 11.4 (2.7)***	87	- 47.4	0.92
VAE_ C73	0.5 (0.1)***	2.3 (1.1)**	0.9 (0.7)	- 30.5 (14.4)**	73	- 58.4	0.91
VAE_ C74	0.2 (0.2)	1.7 (0.3)***	0.7 (0.2)***	- 19.4 (5.4)***	88	- 60.0	0.87

Standard deviation between brackets. *: 10% significant. **: 5% significant. ***: 1% significant.

19 Results are not shown for this explanatory variable.

20 In the results presented here an indicator of country specialisation VA_{ij}/GDP_j was used, but the results remain quite good when using an indicator of industry activity in absolute levels, such as VA_{ij}

106. The third quite significant explanatory variable is the overall openness of the country to foreign investors, measured in our equation by the ratio $FRAT_j(t)$ (Total inward FDI stocks/GDP). All things being equal, a country globally opened to FDI will attract more projects in a given industry than a more closed one. This variable is especially helpful to take into account the case of small countries, very opened to the international economy, and located at the very heart of large regional markets, such as Belgium or the Netherlands.

107. By industries, results are satisfying for most of the manufacturing activities, with the exception of C353 and C30. For C353, It should be noted that location decisions in the aircraft and space industries are submitted to strong political influence due to the their nature of "sovereignty industries". They might be not fully explained by mere economic approaches such as the ones that we shall implement in the present study. For C30, an analysis of country data show the existence of many statistical breaks, due to either large M&As, or to a brutal change in the industry classification of some foreign subsidiaries (see also detailed industry analysis below).

4.1.2 Foreign-controlled R&D expenditures

108. Various empirical tests have finally led to select the following econometric formulation (equation (5) and table 7):

(5) log(RDEi,j(t))= F (log(PIBPOTj(t)), log(RDi,j(t)/VAi, j(t)), log(VAEi,j(t)/VAi,j(t)), log(VAi,j (t)/GDPj(t)), C)

(F = linear equation, panel regression with fixed effects)[21]

109. This equation has been tested for manufacturing industries only, due to the lack of data on R&D foreign-controlled expenditures in the services sector.

110. As in the case of value added, the PIBPOT variable, indicator of market potential, has a very positive and significant impact on the location of R&D expenditures in most of the IRI. This finding is resilient to the choice of the market indicator, as the national GDP also appeared as very significant in alternative formulations[22]. This confirms a very common finding of the existing literature on the importance of proximity to market for the location of R&D (especially downstream R&D: development and support).

111. The existence of co-location effects between R&D and production activities was tested by introducing the VA_i/GDP and VAE_i/VA variables. As expected, these two variables have a positive and quite significant impact in a majority of the industries for which the equation was tested. This means that, the more a country is specialised a certain industry in terms of value added or production, and the more this industry is foreign controlled, the more it will also attract foreign controlled R&D.

112. The RD_i/VA_i ratio was introduced in the equation in order to control the impact of the innovation-intensity of the industry on the results. As could be expected, this variable has a positive and significant impact of the overall level of foreign controlled R&D, leading to a quasi-tautological (but necessary) result: all things being equal, the absolute level of foreign-controlled R&D is higher when the industry is more technology-intensive.

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21 For the definition of the variables mentioned in equation (5), please refer to table 5.

22 Results are not reproduced here.

113. Other significant explanatory variables gave interesting results, but were finally not selected in the final formulation presented here. This is the case, in particular, of the indicators of global R&D intensity of the country (number of patents granted to residents and business RD/GDP ratio). It would thus be possible to display in this paper some results showing that, the more R&D and innovation oriented the country is, the more foreign R&D expenditures will be made in a given high or medium-tech manufacturing industry. However, the significance of these variables disappear if they are added to the equation (5) displayed above, probably because the impact of the overall technology-intensity of the country is "captured" by such variables as VA_i/GDP or RD_i/VA_i.

114. Other explanatory variables were not significant and thus dropped from the final formulation: this is the case, on the one hand of labour costs, and on the other hand - maybe more surprisingly - of the indicators of quality and/or qualification levels of the working population[23].

Table 7. Determinants of foreign controlled R&D expenditures location in OECD countries (standard model)

	RD_i/VA_i	VA_i/GDP	VAE_i/VAi	PIBPOT	C	OBS.	LK FCT	ADJ R2
RDE_ C15T37	0.7 (0.2)***	0.9 (0.3)***	1.2 (0.2)***	1.2 (0.1)***	10.1 (5.4)*	80	34.5	0.99
RDE_ C24-2423	0.5 (0.3)	0.6 (0.6)	1.2 (0.4)**	0.8 (0.5)*	13.0 (9.5)	61	- 7	0.96
RDE_ 2423	0.5 (0.3)*	0.6 (0.2)***	1.6 (0.05)***	1.7 (0.1)***	5.8 (3.4)*	61	- 19.2	0.98
RDE_ C29T33	-0.3 (0.4)	0.2 (0.5)	0.9 (0.5) *	1 (0.3) ***	- 3.2 (11.2)	57	- 9.0	0.95
RDE_C29	0.3 (0.3)	- 0.3 (0.2)	0.9 (0.1) ***	1.2 (0.3) ***	9.2 (6.2)	70	- 21.0	0.95
RDE_ C30T33	0.2 (0.3)	1.0 (0.4)**	0.9 (0.2)***	2.1 (0.4)***	-19.5 (6.7)***	50	1.2	0.94
RDE_ C30	0.5 (0.3)*	1.1 (0.7)	1.4 (0.3)***	1.4 (1.8)	1.4 (26.7)	48	-65.8	0.89
RDE_ C31	0.8 (0.5)	1.3 (0.9)	1.2 (0.1)***	1.6 (0.6)**	1.0 (14.3)	58	-49.5	0.91
RDE _C32	-0.3 (0.6)	0.8 (0.7)	1.4 (0.3)***	1.1 (0.8)	- 1.6 (11.4)	53	- 46.9	0.92
RDE_ C33	0.6 (0.2)***	1.9 (0.4)***	1.2 (0.5)***	1.7 (0.6)***	- 9.0 (9.5)	67	- 56.2	0.93
RDE_ C34	1.1 (0.4)***	1.1 (0.2)***	1.5 (0.1)***	1.9 (0.3)***	6.0 (4.8)	54	- 27.99	0.95
RDE_ C353	0.1 (0.2)	0.3 (0.3)	0.2 (0.0)***	1.0 (0.1)***	- 11.3 (1.1)***	14	24.6	1.0

Standard deviation between brackets. *: 10% significant. **: 5% significant. ***: 1% significant.

4.1.3 Foreign-controlled employment

115. After various empirical tests, the following econometric formulation has been selected as our "standard model" (equation 6 and table 8):

(6) log(EMPEi,j(t)) = F(log(VAEi,j (t), log(ENVTj(t)), log(INDSSALj (t), C)

(F = linear equation, panel regression with fixed effects)[24]

[23] An empirical analysis of data shows that this last indicator is in fact not very much correlated with the overall R&D intensity of the country, as illustrated by the case of Germany (high level of R&D expenditures, but quite limited share of highly educated workers in the total population).

116. One of the major findings here is that, for a given level of foreign-controlled value added in the country, the level of employment in foreign affiliates is negatively and significantly correlated to the wages costs. In other terms, it shows that companies tend to locate the most labour-intensive segments of their value chain in countries with relatively lower labour costs.

117. Another interesting finding is the positive and rather significant impact of government effectiveness in the location of foreign controlled jobs[25].

Table 8. Determinants of foreign-controlled employment location in OECD countries

(Standard model)

	ENVT	INDSSAL	VAE_i	C	OBS.	LK FCT	ADJ R2
EE_ C15T37	- 0.1 (0.1)	- 0.3 (0.1) ***	0.6 (0.1) ***	6.0 (1.0) ***	132	145.7	0.99
EE_ C24-2423	- 0.1 (0.0) *	- 0,3 (0.1) **	0.2 (0.1) ***	8.4 (0.6) ***	82	89	0.995
EE_ 2423	0.0 (0.1)	- 0.7 (0.2) ***	0.5 (0.1) ***	5.2 (0.4) ***	82	69.7	0.995
EE_ C29T33	- 0.2 (0.1)*	-0.6 (0.1) ***	0.5 (0.1) ***	6.7 (0.7) ***	78	86.6	0.99
EE_ C29	0.0 (0.1)	- 1.1 (0.1) ***	0.8 (0.1) ***	3.7 (0.4) ***	122	108.0	0.99
EE_ C30T33	- 0.1 (0.0) **	- 1.0 (0.2) ***	0.6 (0.1) ***	5.8 (1.0)	89	78.8	0.99
EE_ C30	- 0.1 (0.2)	- 1.0 (0.5) **	0.7 (0.1) ***	3.9 (0.5) ***	76	- 17.8	0.94
EE_ C31	- 0.1 (0.1)	- 1.5 (0.3) ***	0.7 (0.0) ***	4.1 (0.2) ***	108	20.1	0.97
EE _C32	- 0.2 (0.1)	- 1.3 (0.2) ***	0.6 (0.1) ***	4.7 (0.4) ***	100	38.8	0.98
EE_ C33	- 0.1 (0.0) ***	0.0 (0.3)	0.5 (0.1) ***	6.0 (0.6) ***	98	57.8	0.98
EE_ C34	- 0.2 (0.1)	- 1.0 (0. 1) ***	0.8 (0.0) ***	4.0 (0.4) ***	94	40.6	0.99
EE_ C353	0.0 (0.2)	- 0.1 (0.2)	0.8 (0.0) ***	3.5 (0.3) ***	35	21.2	0.99
EE_ C64	- 0.2 (0.5)	- 1.5 (0.5) ***	1.0 (0.1) ***	1.7 (0.6) ***	38	10.3	0.91
EE_ C65T67	- 0.7 (0.1) ***	- 0.4 (0.4)	(0.7 (0.1) ***	4.4 (1.4) ***	19	2.53	0.95
EE_ C72	0.1 (0.1)	0.0 (0.3)	0.5 (0.1) ***	6.1 (0.6) ***	75	15.6	0.98
EE_ C73	- 0.6 (1.0)	- 0.7 (1,8)	1.2 (0.1) ***	1.4 (1.4)	62	- 91.3	0.81
EE_ C74	0.2 (0.2)	- 0.8 (0.4) **	0.7 (0.1) ***	5.5 (0.8) ***	80	- 0.33	0.99

Standard deviation between brackets. *: 10% significant. **: 5% significant. ***: 1% significant.

118. The skills and qualifications variables (HQ and EDUC), however, give quite disappointing results. A positive, even if limited, impact, could have been expected. This is not the case, and in some industry, this variable even takes the unexpected sign (negative). It thus unfortunately had to be dropped

24 For the definition of the variables mentioned in equation (6), please refer to table 5.

25 This positive impact was already noted in the case of the added value, but finally dropped from the standard model due to its low significance.

form the standard model. However, they appear as quite significant, in a number of industries, and with the expected sign, in various alternative formulation, as will be showed below (see also Annex 2).

4.1.4 Two additional tests: FDI stocks and number of foreign affiliates

119. In order to confirm the results obtained in the three major series of econometrical tests described above, and also to take advantage of the possibilities opened by the AFA and FATS data bases, two additional series of tests have been carried out on the two following explained variables: FDI stocks (expressed in current dollars terms) and the number of foreign affiliates.

120. The "standard model" tested in these two cases is directly inspired from the ones used in the case of foreign controlled value added. However, in each of theses cases, we tried to introduce a supplementary explanatory variable, of the same nature as the explained variable: total capital stocks in the FDI equation; and number of total domestic firms in the foreign subsidiaries equation. However, the variable "Total capital stocks" was finally dropped from the "standard model" for FDI stocks, due to its low level of significance in most industries (see equations 7 and 8)

(7) log (FDIi,j (t)) = F(log(PIBPOTj(t), log(FRATj(t)), log(VAi,j(t)/GDPi,j(t)), C)

(F = linear equation, panel regression with fixed effects)[26]

(8) log(NUMBEi,j(t)) = F(log(PIBPOTj (t), log(FRATj(t), log(ENVT j(t), log(NUMBi,j(t), C)

(F = linear equation, panel regression with fixed effects)

121. Globally, these two sets of equation give satisfying results, with a generally good explanatory power and a good level of significance for most of the parameters (tables 9 and10). They thus confirm some of the major findings of our standard model of "value added" location: positive and significant impact of the size of the potential market, of the overall openness of the country to FDI and of "agglomeration" and/or "country specialisation" effects. In particular, there is a significant and positive impact of total number of companies in industry i on the number of foreign affiliates in the same industry.

[26] For the definition of the variables mentioned in equation (7) and (8), please refer to table 5.

Table 9. Determinants of FDI location in OECD countries (Standard model)

	VA_i/PIB	PIBPOT	FRAT	C	OBS.	LK FCT	ADJ R2
C15T37	0.3 (0.4)	1.1 (0.1) ***	0.8 (0.1) ***	- 12.2 (5.9) **	357	8.6	0.98
C24M2423	0.9 (0.2) ***	1.2 (0.2) ***	0.6 (0.2) ***	- 20.6 (3.3) ***	49	23.3	0.99
C2423	0.7 (0.7)	1.3 (0.3) ***	0.4 (0.0) ***	- 20.6 (9.0) **	53	7.3	0.99
C29t33	0.9 (0.5)*	0.4 (0.3)	0.8 (0.1)***	- 10.0 (3.1)***	56	27.9	0.99
C29	1,0 (1.0)	1.6 (0.4) ***	0.4 (0.4)	- 27.8 (11.8) **	249	- 316.5	0.88
C30t33	- 0.1 (0.4)	0.6 (0.3) *	0.8 (0.1) ***	- 2.0 (4.0)	56	7.1	0.98
C30	0.1 (0.3)	0.7 (1.2)	1.3 (0.4)***	- 10.3 (16.3)	109	- 133.4	0.91
C31	NA	NA	NA	NA	NA	NA	NA
C32	0.6 (0.3) *	0.2 (0.5)	0.8 (0.6)	- 4.3 (8.4)	154	- 216.0	0.81
C33	- 4.2 (1.2) ***	3.3 (1.1) ***	0.0 (0.2)	- 8.9 (13)	65	- 46.2	0.95
C34	0.4 (0.8)	2.3 (0.8)***	0.0 (0.6)	- 31.4 (11.3)	177	- 261.0	0.79
C352	0.5 (0.2) **	1.6 (1.0)	0.0 (0.4)	- 22.8 (13.1)*	24	8.0	0.995
C64	10.1 (3.6) **	20.2 (4.4) ***	- 1.8 (1.8)	- 251.1 (54.0)***	26	- 38	0.71
C65T67	0.1 (0.0)***	1.9 (0.2) ***	1.0 (0.1) ***	- 22.1 (3.3) ***	15	11.7	0.98
C72	0.0 (0.0)	2.7 (0.6) ***	1.4 (0.3) ***	- 38.3 (8.1) ***	36	- 22.2	0.95
C73	0.0 (0.1)	3.0 (2.0)	2.1 (0.6)***	- 47.8 (28.1)*	42	- 44.6	0.9
C74	0.0 (0.0)	1.7 (0.9)**	1.5 (0.2)***	- 20.5 (12.1)*	59	- 29.7	0.95

Standard deviation between brackets. *: 10% significant. **: 5% significant. ***: 1% significant.

Table 10. Determinants of foreign-controlled foreign subsidiaries location in OECD countries (Standard model)

	PIBPOT	FRAT	ENVT	NE_i	C	OBS.	LK FCT	ADJ R2
C15T37	0.0 (0.3)	0.5 (0.2)***	- 0.1 (0.1)	0.0 (0.1)	5,4 (5.4)	147	- 16.0	0.92
C24 M2423	0.1 (0.1)	0.2 (0.1)**	- 0.1 (0.0)	0.2 (0.1)*	2.0 (1.9)	86	56.5	0.97
C2423	- 0.2 (0.2)	0.3 80.2)	0.0 (0.2)	0.7 (0.1)***	1.1 (2.1)	86	32.0	0.98
C29t33	0.8 (0.3)***	0.1 (0.1)*	- 0.1 (0.1)	0.1 (0.1)	- 7.6 (4.2)*	94	28.3	0.96
C29	0.4 (0.2)*	0.4 (0.1)***	- 0.1 (0.0)***	0.1 (0.1)	- 2.2 (2.7)	129	44.5	0.97
C30t33	1.1 (0.5)**	0.2 (0.1)**	- 0.1 (0.1)	0.1 (0.1)	- 12.2 (7.6)*	94	- 67.8	0.76
C30	0.1 (0.3)	0.1 (0.2)	0.2 (0.2)	0.0 (0.1)	1.5 (4.9)	102	- 11.8	0.93
C31	0.1 (0.3)	0.3 (0.1)***	0.0 (0.1)	0.2 (0.1)***	- 0.4 (3.7)	119	19.9	0.94
C32	0.4 (0.2)**	0.5 (0.2)***	- 0.1 (0.2)	0.1 (0.1)**	- 4.6 (3.5)	116	- 1.4	0.92
C33	0.8 (0.4)**	0.3 (0.1)***	- 0.2 (0.1) ***	0.1 (0.1)	- 9.6 (4.9)**	114	8.9	0.96
C34	0.6 (0.2)***	0.4 (0.2)**	0.2 (0.2)	0.2 (0.4)	- 8.1 (3.7)	108	0.3	0.95
C352	0.2 (0.4)	0.5 (0.2)***	0.1 (0.1)**	0.3 (0.1)***	- 4.4 (4.9)	71	12.6	0.97
C64	NA	NA	NA	NA	NA	NA	NA	NA
C65T67	NA	NA	NA	NA	NA	NA	NA	NA
C72	NA	NA	NA	NA	NA	NA	NA	NA
C73	NA	NA	NA	NA	NA	NA	NA	NA
C74	NA	NA	NA	NA	NA	NA	NA	NA

Standard deviation between brackets. *: 10% significant. **: 5% significant. ***: 1% significant.

4.2 Analysis by industry

122. So far, we have not very much insisted, in the presentation of the results, on the existence of specificities by industry. However, there are major reasons to believe that location criteria may differ, sometimes largely, depending on the activities. This intuition is evidenced by the results of our econometric regressions. It can also happen that some equation specifications, although not giving good results for most of the industries, and thus not selected as our "standard models", may work quite well for a limited number of activities. This section is dedicated to a presentation and discussion of these specificities.

4.2.1 Chemicals and pharmaceuticals

Pharmaceuticals industries

123. A review of literature shows that the location of pharmaceutical activities is very sensitive to both markets, the availability of skills and a favourable industrial environment (box 2). The results of the UNCTAD's WIPS survey (UNCTAD, 2009b, table 4) show for instance that location decision in pharmaceuticals are especially sensitive to the presence of skills and talents, to access to the regional market and to government effectiveness (pricing, licensing, IPR). Agglomeration effects also appear to be

playing an important role. This is evidenced by the fact that, inside OECD, countries with large domestic pharmaceutical R&D and production activities are also the most attractive to FDI in this activity (OCDE, 2007).

124. Location criteria, however, differ significantly depending on the business function involved (R&D or production).

125. Regarding R&D, pharmaceutical is one of the industries where research activities are the most internationalised. The overall quality of the national innovation system (availability of skills and talents, quality of academic research and scientific infrastructure, existence of leading clusters, etc.) seems to be a major location determinant for fundamental R&D (box 2). For adaptation and support R&D, other factors can also play an important role, such the existence of a production base, a favourable business environment (IPR regime, and drug price policy as well as the safety regulations and the licensing regime of new products), the size and growth of the market. In particular, final stages of the innovation process (ex. clinical tests) may be located on the final market to facilitate licensing procedures. The presence of a fiscal regime supportive of R&D may be a plus. Finally, R&D location is not very sensitive overall to labour costs. Some cost cuts-seeking off shoring has been observed in specific segments of the innovation chain such as clinical trials, but the impact of this trend remains limited (Cockburn, 2008).

Box 2. Some evidences on location determinants of foreign R&D in pharmaceuticals

- The scientific level of university research departments has a very positive impact on the location of private sector R&D labs in pharmaceutical (Abramowsky, Harrison and Simpson, 2007).

- The location of the pharmaceutical industries seems also very sensitive to the presence of scientific excellence centres. Serapio and Dalton (1999) find that the foreign R&D presence in the United States is especially high in pharmaceuticals and biotechnologies, and that the quality of scientific infrastructure is especially influential for the location of theses activities.

- Madhok and Osegowitch (2000) point out the special importance of the home-base augmenting motive in the internationalisation of R&D.

- Florida (1997) find that the internationalisation of biotechnology is motivated by the access to foreign science and technology to a greater degree than other industries, such as automotive, where market consideration have more impact.

126. Regarding production and value added, it may be interesting to classify location factors in pharmaceuticals depending on the geographical level for which they are pertinent On this question, see also AFII, 2007, pages 20-21). Access to market is an important location determinant for production facilities, especially at a continental-wide level, as pharmaceutical companies tend to set up a production facility for a given product on each large market (=continent) of the planet. At the national level, the quality of business environment (especially drug price regulation, licensing procedures, absence of red tape, easiness to open a new business) is important. At a more local level, pharmaceutical production is highly dependent on the existence of high quality infrastructures (water, power, logistics), and very sensitive to clusters effects (presence of suppliers and coo-petitors, a large skilled labour market). Incentives may be a plus, but are not a major location factor. Labour costs are not generally mentioned as an important location determinant in most of the cases, due among other to the fact that manufacturing accounts only for a limited share of total cost of the product (as compared to R&D, marketing and distribution costs). However, the manufacturing of generic drugs, where production costs are a more important issue than for new products protected by patents, could be an exception to this (Cockburn, 2008).

127. Most – but not all - of the results of our econometric regression confirm these hypotheses (Annex 2). First, the location of value added is significantly influenced by the presence of a market, the overall openness of the economy to FDI and the specialisation of the country in pharmaceuticals. Another

evidence of the presence of agglomeration effects is the fact that the number of foreign affiliates in the country is positively and significantly correlated to the number of domestic companies. The quality of the local labour force also has a positive, although not vey significant, impact on the location of foreign controlled value added.

128. On the other hand, the quality of public governance, although having the positive expected sign, does not appear to be very significant in our own findings. This does not fit perfectly with other sources, such as surveys among pharmaceutical companies executives, who generally mention regulatory issues (such as licensing procedures, price policies, protection of intellectual property, construction licences) as key location determinants in their business.

129. Another surprising finding is that wages cost seems to have a significantly negative impact on the location of jobs by multinational companies in pharmaceuticals. This does not confirm our initial hypothesis that, due to the very capital intensive and high labour productivity of the pharmaceutical industry, labour costs might have only a limited impact on location decisions.

130. For foreign controlled R&D, The usual explanatory variables of our standard model are significant with the expected sign.

Chemicals (others than pharmaceuticals)

131. Chemical industries encompass a broad scope of very specialised and interdependent activities, against the background of complex value chains. Some of these products (especially in intermediate goods) are not very easy to transport on the long distance. It is also a very capital-intensive industry, employing a very high share of medium to highly skilled people, but with a limited share of labour compensation in total production costs, as compared to other manufacturing industries. It is thus expected that location decisions will be influenced by the proximity to markets, the existence of agglomeration effects, the qualification of labour, as well as the quality of the industrial and administrative environment, but that labour cost will not appear as a significant deterrent.

132. Results of our econometric regressions confirm these hypotheses in broad terms (Annex 2). The location of foreign controlled value added is positively and significantly influenced by the size of market (potential GDP), the level of specialisation of the country in chemicals, the quality of government and the overall openness of the country to FDI.

133. Regarding employment, results also confirm our hypothesis. As expected, the location of jobs is significantly influenced by the overall quality to the labour force, but the impact of labour costs is not very significant.

134. For foreign controlled R&D, the usual explanatory variables of our standard model are significant with the expected sign.

4.2.2 Electric and electronic industries

135. In these activities, especially in electronics and computers, a global division of labour is taking shape, with upstream R&D being located mainly to the proximity of major scientific clusters in developed countries, while, the most labour intensive of mass production is relocating to low wages countries, mainly in developing Asia. It is thus not surprising that a review of the existing literature points out to the existence of various location factors depending in the value chain segments (box 3):

- Regarding upstream R&D, agglomeration effects around technological and scientific excellence centres, the availability of skilled labour, but also the proximity to market and customers, are major location determinants.

- Regarding downstream R&D activities and process innovation, there is also a co-location effect with production capacities. Some development and R&D support activities can also be cost-sensitive (availability of cheap and skilled labour).

- Regarding production activities, the quality of the technical and legal environment, the proximity to markets, but also in many cases the availability of large polls of labour with a good quality/cost ratio are major location determinants.

Box 3. Evidences about location factors in ITCs: some findings of the literature

- A report by Barrios & al. (2008) for the European commission finds that major location determinants for ICTs inside the EU are: the level of regional GDP, the degree of industrial specialisation, the level of education and the density of SMEs established in a particular region. The level of industrial specialisation appears to be especially important in the case of the computing service industry while the presence of SMEs appear to be more influential for ICT manufacturing.

- Barry and Curran (2004) find that the computer-assembly activity, very sensitive to labour cost, is likely to relocate from Western towards Eastern Europe, while segments more in need of skilled labour and high quality industrial environment, such as the production of electronic components and R&D activities, are less likely to migrate.

- Regarding the French case, a study by Le Gall (2008), on the basis of a survey among French subsidiaries of foreign companies, identifies three sets of location determinants in ICT industries: the proximity to market and consumers, the existence of technological and scientific resources, and the possibility to collaborate with local partners on innovative projects.

- UNCTAD's WIPS results (table 4) show that, in addition to access to markets, two other location determinants seem to be especially important for ITC industries: cheap labour (for the manufacture of mature products) and skilled labour (for the conception and development of new, innovative products).

136. The results of the econometric regressions carried out for the whole electric and electronic industries are rather in line with the findings of the existing literature. The location of value added is found to be positively and significantly influenced by the presence of markets, the overall openness of the country to FDI and its specialisation in these industries, and well as the overall quality of public governance. Foreign-controlled employment is negatively influenced by wages costs and positively (albeit not very significantly) by the quality of the labour force. All the explanatory variables of our "Standard R&D location model" have the expected sign, even if their significance level is not very high.

137. Each industry, however, displays specific characteristics, with a direct influence on location criteria.

138. *The business machine industry* is one of those where multinational companies have implemented the most extensive globalisation strategies, with a functional specialisation assigned to various regions in the world. For instance, in the personal computer industries, which "operates as a global network of independent suppliers of systems, components, peripherals and software" (Dedrick and Kraemer, 2008), the international division of labour is as follow : "component-level R&D is implemented in the US and Japan; applied R&D for new platform (including notebook computers) takes place in Taiwan; and product development for mature products takes (such as desktop computers) as well as a major share of production and sustaining engineering takes place in China. Practically all the increase in computer hardware production since 1995 has taken place in developing Asia, which is now by far the leading region in the

world for this activity". However, most of the design jobs have so far remained located in the OECD area, especially in the US (due essentially to activities carried out by domestic US companies).

139. Inside of the OECD, the location pattern of foreign controlled activities is very much influenced by the fact that a large part of foreign investors in this activity are US companies. This explain why the position of the US as a host country in this industry is quite low, while most of the foreign controlled activities – mostly subsidiaries of US firms – take place in Western Europe with Ireland at the first position (OCDE, 2007). The presence of foreign activities in East-European countries, although still low, has increased much over the past last years.

140. As suggested by the preceding review of literature, it could have been expected that our standard model would display a high explanatory power, with both market, agglomeration and cost effects being identified as significant location variables. However, results of our econometric tests in this industry have been rather disappointing, with most of the tested variable being not significant (Annex 2). This may be due, among other causes, to the limited number of observation available. In addition, time series show many breaks, most probably due to the implementation of major cross border M&As which may have a brutal impact on the level of foreign presence, as this industry is characterised by a strong concentration of activities among a limited number of large-scale players.

141. Another possible explanation of these mediocre results might be that FDI and foreign-controlled activities might not be a good or complete enough approach to capture the internationalisation of production and R&D. As a matter of facts, there is a growing trend in the PC industry to outsource development to Original development Manufacturers (ODMs) or to set up partnerships between PC seller and ODMs to develop products. These key issues cannot be ignored in a discussion on the geographical location of activities.

142. *In electric industries***,** all the explanatory variables of our "standard model" appear with the expected sign, but are not in general very significant, for value added as well as for R&D. Wage costs seem to have, as expected, a significant negative impact on the location of foreign controlled jobs.

143. *In electronic equipment and components*, a growing vertical specialisation at both companies and countries level has been taking place during the past twenty years. The innovation value chain is thus rather segmented, with a decreasing role of integrated device manufacturers and a growing role of the fabless/contract manufacturers partnerships, and also a growing integration with softwares industries. This segmentation has favoured the development of international production networks, with a specialisation of various countries depending on the nature of their location advantages. In particular, a wide relocation trend has been observed to the benefit of low wages developing Asia in mass production activities, to the detriment of OECD countries. In contrast R&D activities, which remain by far less internationalised than in other industries like pharmaceuticals[27] (Macher, 2008), are also still carried out in their vast majority in developed countries[28].

144. These elements raise high expectations regarding the capability of our "standard location models" to provide evidence of various hierarchies of location criteria depending on the nature of the explained

[27] Only a small share of US and Japanese TNCs' R&D is carried out abroad and the innovation process remains "homebound", including for development fabs. European companies' R&D however, seems to be slightly more internationalised. In the recent years, there has been only a modest growth of off shore R&D activities by US fabless companies (largely focused on the Asian-Pacific region).

[28] The continuous progress in production and design capabilities in South East Asia is however likely to result in expanded off-shore product design and development activities by US firms in this region and the entry of new firms based in this region

variable (employment, R&D, production, etc.) in the electronic industry. The result of our econometric regression partially meet these expectations, but with some important limitations (Annex 2). On the one hand, most of the variables of our "standard location models" are significant, with the expected sign, for the location of FDI, number of subsidiaries, and employment. This provides evidence of the importance of market access, agglomeration effects, and public governance, among others, for the location of these activities abroad. Employment is also proven to be sensitive, as expected, to wages costs. On the other hand, it has not been possible to find evidence of the positive impact of the quality of the labour force on the location of employment. In addition, the explanatory power of our standard models is quite limited in the cases of value added and R&D, with many variables appearing as not significant, although with the expected sign.

145. *In the scientific instruments sector***,** most of the variables of our standard location model are significant with the expected sign, for value added as well as R&D and employment, with a significant impact of labour costs.

4.2.3 Other equipments, including transport

Machines and mechanical equipments

146. In this industry, based on very specialised skills it could be expected that the location of foreign controlled activities will be especially sensitive to the existence of a favourable technical and industrial environment.

147. As a matter of fact, our econometric estimates show a strong positive impact of the country's specialisation in machines production on location decisions in these activities. The proximity to market also appears to be a key location determinant. The openness of the country to FDI or the quality of the public governance also has a significant positive impact in many cases (Annex 2).

148. Regarding employment, the quality of the workforce and labour cost are also found to have a significant impact (with the expected sign) on location decisions.

149. For foreign controlled R&D, the usual explanatory variables of our standard model are significant with the expected sign.

Automotive industry

150. This industry with a very long product value chain (from components and equipment manufacturing to car assembly) is also characterised by complex location decision process taking into account a large number of sometimes conflicting criteria. For instance, wages costs play an important role in this very labour-intensive industry, but the access to market (including to the downstream of automotive industry for equipment manufacturers) is also influential, as well as the existence of a good industrial and technical environment. It is thus expected that all the variables of our "standard model" will appear as significant in our regressions.

151. Results of our econometric regression fit quite well to these expectations. First of all, the location of value added is extremely sensitive to both market size (as proxied by potential GDP) and variables related to agglomeration effects and country specialisation in the automotive industry. Overall openness to FDI also appears as having a significant positive influence on location decisions. Employment level is, as expected, extremely sensitive to labour costs.

152. For foreign controlled R&D, The usual explanatory variables of our standard model are significant with the expected sign.

Aerospace industries

153. At first sight, it could be considered that location decision in the aerospace industry would be somewhat difficult to analyse in strictly economic terms, as they might be influenced, more than in other activities, by political factors stemming from their key role in national security issues. This is also one of the major reasons which have constrained so far the internationalisation of this industry in terms of FDI. One additional complication stems from the fact that the market of large segments of this industry is global in nature, and thus not clearly related to the size of the local market.

154. As expected, the low value of the R^2 test in our regressions show that our model has basically a quite limited explanatory power. However, many of the explanatory variables of our "standard models" have been found to have the expected sign, with a good level of significance. For instance, the location of foreign controlled value added appears to be strongly influenced by the specialisation of the domestic economy in aerospace activities and the global openness of the country to FDI. As expected, the size of the local market (as measured by potential GDP) does not seems to play an influential role in location decision, which might be explained, in particular, by the fact that these industries are in a position of easily exporting their products worldwide.

155. Regarding the location of employment, aerospace appears to be one of the manufacturing industries where the wages costs variable are be the less significant for the location of jobs abroad. This result is not counter-intuitive, but should not hide the fact that in the recent years, some labour-intensive equipments and components manufacturers (such as seats) have decided to locate in cheap labour countries for cost-efficiency reasons.

156. It should be finally stressed that the low number of observations available in this industry hampers the reliability of our econometric results.

4.2.4 Services industries

Post and telecommunication

157. This industry is a good example of a "multi-domestic activity" (Porter, 1986), where location strategies are mainly focused on access to market, with relatively limited influence of local costs and access to resources. It should be thus expected that labour costs and agglomeration effects will be of less significance in our results that variables related to the size of market and openness of the country to foreign investment.

158. Our findings fit quite well to these guesses. For instance, the level of foreign-controlled value added is significantly influenced only by the market size and the overall level openness of the economy to FDI, and not by other variables of the standard model. There is also a negative influence of the level of wages and a positive influence of the overall education level in the country, but with a low level of significance.

Financial intermediation

159. Given the nature of this industry, it could be reasonably guessed the level of foreign presence in the country should be strongly influenced by three major factors: the size of the local market of financial products, itself related to the overall size of the domestic economy; the relative specialisation of the country in financial activities; and the openness of this activity to foreign investors. On the other hand, it is not expected that the level of wages will play a significant role in location decisions.

160. Findings of our econometric study fit quite well to these expected results. The level of foreign controlled value added is significantly influenced by the size of potential GDP, the specialisation of the country in financial services and the overall openness of the country. There is no significant impact of labour costs on the location of jobs, but decisions regarding employment levels seem to be influenced by the share of high and medium qualified staff in the total working population.

R&D, computer related activities and other business activities

161. It is expected that these activities very intensive in skilled labour will be especially sensitive to the level of qualifications/education level, as well as, for at least some of them (R&D in particular), to criteria related to innovation capabilities and overall R&D efforts. In addition, proximity to market is also supposed to play an important role as a location determinant. For instance, software developers need to be located close to their final users, due to the importance of interaction with them "in the early stages of complex projects" (Arora and alii, 2008). However, the role of labour cost may also become more and more significant in some activities. For instance, some software development activities are shifting "to off shore sites characterised by low cost and highly skilled manpower" (op. cit.).

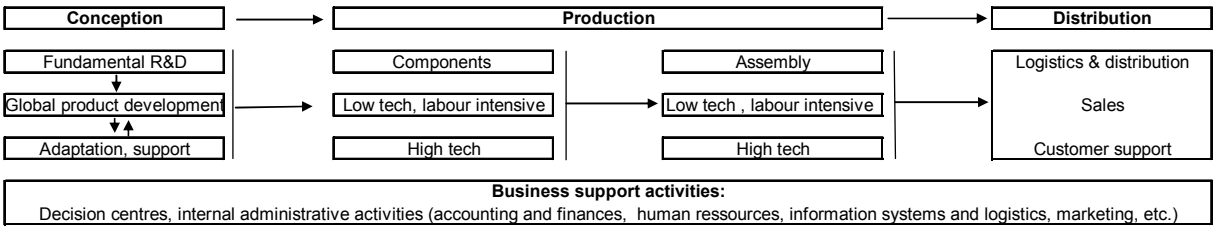
162. Results of our econometric tests fit relatively well with these hypotheses, especially regarding the role of market access and the positive impact of the domestic economy's specialisation. However, there are some differences depending on the industries. For instance, while the location of employment in computer-related and other business activities seem to be sensitive to labour costs, this does not seem to be the case for R&D activities, which on the other hand have been found to be more sensitive to variables related to labour qualification.

4.3 An underlying generic location model

4.3.1 Shaping the model

163. The results of our five sets of econometric tests must not be considered separately from each others, but as illustrating various aspects of a generic location strategy of the various components of a MNE company value chain. A stylised representation of this value chain might be as follows (figure 3):

Figure 3. MNE product value chain: a stylised representation



164. In other terms, a standard company value chain is composed of the following elements: 1) R&D (with three components: upstream/fundamental research; midstream/global product development; downstream/product adaptation and support R&D activities); 2) production (with two components: upstream/intermediate products, downstream/assembly of final product, and two levels of technology-intensity in each); 3) distribution, sales and customer support services. In addition, business support functions are also featured in the figure, although they are not explicitly taken into account in this study.

165. Results of the *value added equations* show that the location of this last type of variable is very sensitive to the size of market, the openness of the country as well as agglomeration effects. Such component of the value chain as distribution, customer support services, as well as R&D adaptation

activities, might in particular be located close to the final markets. In addition, a big deal of downstream production and development R&D could also be located close to the main markets and customers, with a special focus on countries offering an attractive environment due to the presence of a large industrial base and a good level of openness to international investment.

166. The results of the *employment equations* show, however, that the location of jobs (in terms of headcounts) is sensitive to labour costs. This might be particularly the case of the most labour intensive components of the value chain, especially in mass production activities. Some very large factories producing either components or final products, and with a quite low technological intensity, might thus be located in countries offering a good wage/productivity ratio, especially if these countries also benefit from other advantage, such as a large and fast growing market and an overall openness to international investment.

167. Finally, the results of the *R&D expenditures equations* show that the location of foreign R&D activities is very sensitive to the existence in the host country of a good scientific infrastructures and an efficient national innovation system. This may be especially the case for upstream R&D, while other segments of this activity (such as product development) might also be sensible to other factors, such as the proximity to an industrial base and a final market.

168. On the basis of this analysis, it is possible to build a stylised representation of what could be the optimal location of the various components of the value chain of a MNE operating in IRI, in the context of a totally globalised world economy, and with limited coordination, transaction and transportation costs (table 11).

Table 11. Optimal location of the various components of the value chain

Component of the value chain		Optimal location
R&D	Upstream (fundamental R&D)	Close to scientific and industrial excellence centres (very developed countries, with availability of skills and talents)
	Midstream (Global development)	Close to large industrial centres and final markets. Not indifferent to labour cost/quality ratio.
	Downstream (adaptation, support)	Close to large industrial centres and final markets.
Production	High tech	Close to final markets; in countries offering a good industrial and technical environment.
	Labour intensive, low tech	Mostly in countries offering low production costs, with a part close to large final markets.
Distribution, sales, customer support		Close to the large final markets

169. Many articles in the academic literature give a description of the geographical breakdown of the value chain, especially in various components of the ITC industries, very similar to that presented in the previous section of this paper. This is the case, in particular, of the PC and electronic components industries (Macher and Mowery, 2008).

4.3.2 Limits of the model

170. This very simplified presentation however bears many limits and shortcomings, due to five main factors: 1) the existence of high transaction and coordination costs which might be an obstacle to the geographical fragmentation of the value chain; 2) the non global nature of the value chain in some industries; 3) the unequal importance of various inputs depending on the industry; 4) the role of externalisation and outsourcing; 5) the existence of business support function not taken into account in this model.

171. *The existence of high transaction and coordination costs.* Due to various reasons (existence of tariff barriers, desire to keep some strategic activities close to the home country headquarters, high transport cost for ponderous goods, loss of efficiency stemming from the high distance between various complementary activities), MNE may be reluctant to fragment too extensively the value chain, and/or to internationalise some of its components. Those limitative factors have for example been instrumental in slowing down the internationalisation of R&D functions and the creation of cross-border R&D networks (Hatem and Py, 2008a). They may thus limit the explanatory power of our model, by underestimating the restraining forces to internationalisation. This might however be only a minor limit to our analysis, which is focused on explaining the geographical location of MNEs activities abroad, *e.g.* once these restraining forces have been overcome.

172. *The non global nature of some product value chain.* In some industry, especially in services, most of the products are not internationally tradable[29]. There is thus no room for in-depth geographical fragmentation of the value chain. Complete or quasi-complete integrated value chains must thus be located, independently from each other, close to each of the major markets of the companies. This model, called "multi-domestic" by Michael Porter (Porter, 1986), is for instance clearly dominant in the telecommunication services.

[29] Or are subject to tariff and non-tariff barriers.

173. *The unequal importance of various factors in the production function depending on the industry.* In some IRI, especially in pharmaceuticals, labour cost issues play only a limited role as location determinants, including for the manufacturing activities dedicated to mass production. The access to market, the quality of business environment (both technical and regulatory), the co-location with R&D activities, play a much more important role (AFII, 2007, pages 20-21). So there is not much impetus for a large-scale relocation of labour-intensive segments in low cost countries.

174. *The role of externalisation and outsourcing.* In order to control cost and develop more resilience to markets cycles, MNEs in many industries, including IRI, are implementing large-scale externalisation strategies. For instance, as already mentioned in section 1, the largest share of PCs sold by US PC sellers are in fact assembled by Asian OEM, and include components which are themselves produced by Asian fabs (Dedrick and Kramer, 2008). Even a large share of the MNEs R&D is now subcontracted, including to foreign partners, in the context of so-called "open-innovation networks" (Sachwald, 2008). Our study, however, is only focused on activities carried abroad in-house by MNEs through their foreign subsidiaries: It thus cannot provide any evidence on the trade-off between internalisation and externalisation, which is in fact a major aspect of the underlying choices of internationalisation strategies. However, this limit might also be a minor one, as the criteria behind the choice of a subcontractor might be quite similar to those influencing the location decision of a fully-owned subsidiary.

175. *The existence of business support function not taken into account in our location model.* Some major components of the companies' activities, such as decision centres, internal administration, logistics, etc. have not been explicitly analysed in our study. There are three major reasons for this lack of focus: 1) these transversal functions do no constitute a specific step of the product value chain, but support globally the whole activity of the company; 2) AFA and FATS data base provide no element to measure and explain their specific geographical location pattern; 3) their location determinant might be less related to the industry to which they belong, than to the specific features of the function itself. In other terms, their absence from our study might be finally justified by the fact that their location determinant and patterns are not different in IRI that those in other industry[30].

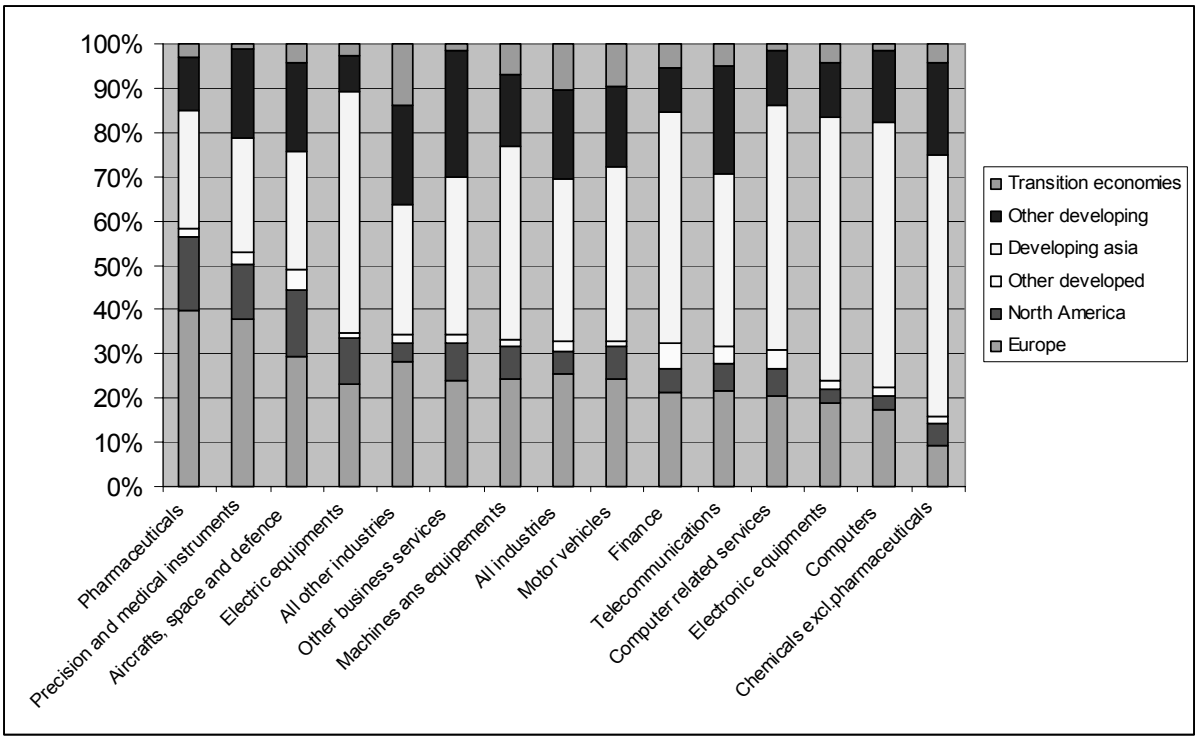
4.3.3 Comforting our model with some empirical observations on greenfield projects

176. Despite its overall simplicity and the fact it has been based on test carried out only on a limited geographical scope (*e.g.* OECD countries), the locational model described above fits quite well with some empirical observations, carried out at the world level on the basis of *FDi Markets* data base, regarding the location of new greenfield projects.

177. First, in all functions and industries, developing countries' markets shares are higher in terms of job created than in terms of number of projects (figure 4 and Annex 3 figure A3.5). In other terms, the average size of projects in terms of jobs is larger in these economies than in the OECD. This is evidence that labour cost have, as expected, a significant negative impact on the location on labour-intensive projects.

[30] However, this hypothesis - which still has to be proven - would also lead to an interesting finding if confirmed. It should thus be tested in future works.

Figure 4. Job creation related to international greenfield projects by host region according to the industry, 2003-July 2009



Source: FDi Markets

178. Second, OECD countries' market shares in IRI remain globally superior to those observed in some other industries, such as in light manufacturing production (Annex 3 figure A3.2). The more technologically advanced a country is, the more attractive it remains for IRI. In particular, developed countries still hold a dominant share of the international projects markets in such industries as biotechnologies, healthcare, aerospace, pharmaceuticals, medical devices and alternative energies. In contrast, the share of developing countries is by far dominant for mining, oil and gas, many heavy industries, real estate, beverages, consumer electronics and even automotive assembly.

179. Third, as regards business functions, developed countries remain more attractive for headquarters, business services and customers contact centres, than for manufacturing, extraction, and shared services centres (Annex 3 figure A3.3). It should also be noted that the market share of developed countries is higher for the upstream of the innovation value chain (R&D) than for the downstream section (design and development). As expected, innovation-intensive and market oriented functions are thus more attracted by OECD countries than more cost-sensitive functions such as production.

5. POLICY IMPLICATIONS: HOW TO ENHANCE OECD COUNTRIES' ATTRACTIVENESS FOR IRA?

180. The on-going economic an financial crisis, by playing a catalyst role in the worldwide restructuring of many IRI, might accelerate the migration of some of its components to emerging countries to the detriment of the industrialised ones. This give even more momentum to the implementation of policies aimed at fostering the attractiveness of OECD countries to IRI, as these countries are confronted to the risk of a progressive weakening of some of their traditional competitive advantages.

5.1 The impact of the economic and financial crisis

181. Since late 2008, the world is going through the worst economic and financial crisis in the post WWII period. Due to a slower growth in markets, a squeeze on both external and internal financial resources and a growing perception of uncertainty, this reduces both the propensity and the capability of MNEs to invest, including abroad. In particular, the on-going crisis might encourage MNEs, for cost-saving reasons, to give more priority, when possible, to non-equity modes of internationalisation (such as outsourcing, licensing, etc.), to the detriment of M&As and greenfields. In consequence, FDI flows have been sharply declining since the last quarter of 2008 onwards, on the context of an overall downward reassessment of MNEs FDI programmes (UNCTAD, 2009b). While M&As have been the most early and massively impacted, greenfield projects have also begun to decline more recently and less markedly since the end of 2008 onwards.

182. While this decline in FDI has been observed in IRI as well as in the rest of the economy, the impact has taken different magnitudes depending on the industry. On the one hand, investment flows in the automotive, chemicals and electronic industries, as well as in financial services have been heavily affected, due to a sharp drop in markets as well as companies profitability. On the other hand, FDI plans some other industries, such as pharmaceuticals and telecommunication services, have showed more resilience, due, among others, to a more sustained growth in markets (UNCTAD 2009b).

183. In addition to this short-term negative impact, many voice have advocated the idea that the unusual magnitude of the crisis might trigger and/or reveal more structural changes in the world economy. The reliant dynamism of emerging economies, contrasting with the sharp recession taking place in most of the OECD countries, might for instance be the sign of the acceleration of the on-going shift in world economic power to the detriment of the latter.

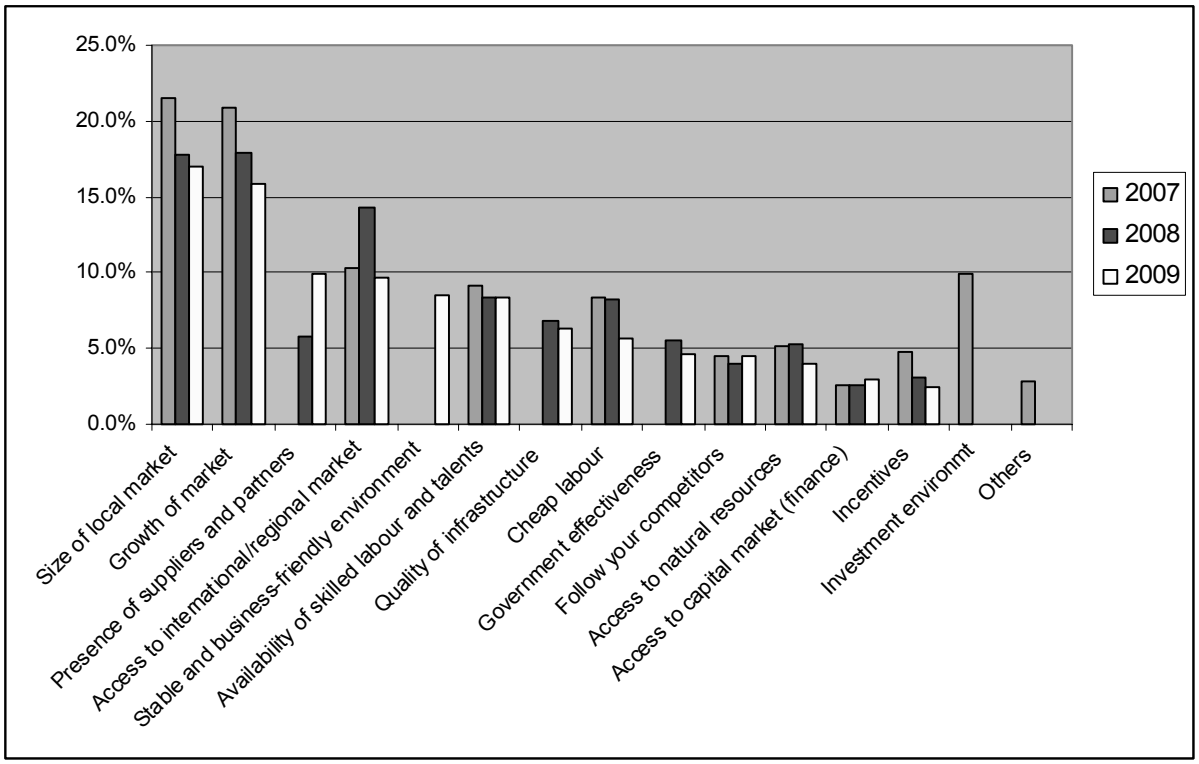
184. It thus could be questioned to what extend these changes might structurally affect MNEs' investment strategies, including in IRAs. On the basis the some recent studies, it is possible to propose here there elements of reply: 1) there is no evidence of a specific major impact of the crisis on FDI location criteria strictly speaking; 2) Despite a short-term decline in investment projects, FDI by MNES in the IRAs might pick up again as early as 2010, due to the reliance of companies' internationalisation trends, provided of course that the on-going world crisis will progressively come to an end. 3) The crisis might however contribute to accelerate some on-going trends in the geographical restructuring of MNES cross-border networks, at all steps of the value chain (research, production, distribution).

185. First, there is no evidence that the on going economic and financial crisis has had a significant impact on the hierarchy of criteria influencing IRAs' decisions on the location of their foreign investment

projects. For instance, the results of two successive yearly surveys among MNEs, carried out by UNCTAD in mid-2008 and mid-2009, respectively, and following the same methodology, show a quite stable pattern investment criteria (figure 5). Access to local and regional market remains in the first place, followed by the quality of the technical and administrative business environment. In particular, the sensitiveness to cost issues (especially to labour costs and incentives) does not seem to have increased, as could have been expected due to the existence of tightest financial constraints. This result is quite coherent with the fact that location criteria are structurally related to the technical and industrial nature of projects, which do not change significantly on the short-term, even in the midst of a very strong world recession.

Figure 5. Location criteria for international investment, 2007 2008 and 2009

(all industries, percent of respondents)



Source: UNCTAD WIPS 2007, 2008 and 2009

186. Second, provided of course that the global crisis will come to an end and that no major structural change - such as a rise in anti-FDI protectionism - will take place in their environment, MNE seem committed to pursue their internationalisation strategies (UNCTAD, 2009b). This is true for all industries, including IRI, and for all business functions, including R&D.

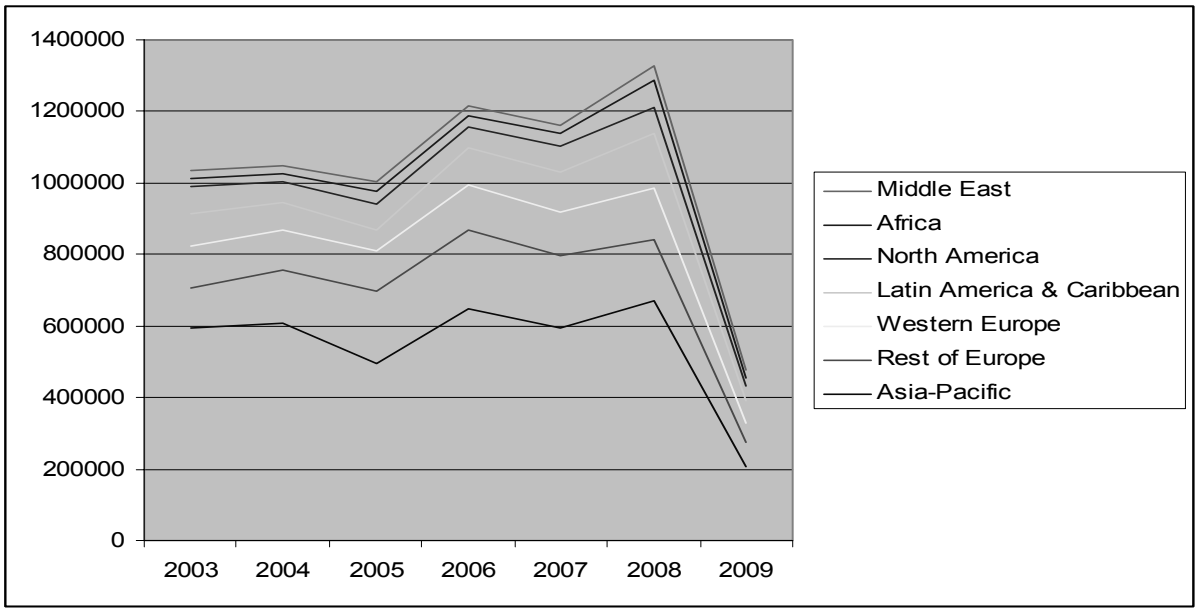
187. In consequence, MNEs international investment flows could pick up again as early as 2010, to reach levels superiors to those observed in 2011. Many IRI non-financial services industries, in particular, benefit both from sustained medium-term market prospects and from a catch-up process in their internationalisation levels (UNCTAD, 2009b).

188. The most striking feature of the present period, however, is that the on-going crisis might accelerate some underlying trends to the international restructuring of IRI, through three major channels: *i)* efficiency-seeking and cost-cutting strategies*, ii)* adjustment to the geographical evolution of markets, and *iii)* restructuring of the supply side through major M&As.

189. In order to weather the dire financial consequences of the crisis, many MNES, especially in IRI, have implemented large-scale cost-cutting strategies (UNCTAD, 2009b). This has mainly taken the form of divestments in the less profitable, and/or cost efficient geographical areas. While some of these divestment have hit developing economies where profits have been disappointing and/or where the level of risks is high, most of them have resulted in site closures and layoffs programmes in OECD countries where cost are high and markets prospects are sluggish.

190. Second, in the context of a decline in their overall new investments, MNEs in IRI might try to preserve the growth of the activities on the most promising markets. The search for low cost production areas may give an additional impetus to this trend. So far, however, the most recent data on greenfied projects by host regions do not show a growing share of emerging economies, to the detriment of developed countries (figure 6).

Figure 6. Job created by greenfield projects in IRI by home regions, 2003- July 2009



Source: FDI markets data base. Data for 2009 are until end to July.

191. Third, despite a sharp drop in the value and even number of cross-border M&As[31] since the last quarters of 2008 onwards, the crisis might trigger new opportunities for this kind of operations (see UNCTAD, 2009a and b). This is mainly due to three factors: *i)* the existence of a large number of ailing companies vulnerable to a possible take-over (as illustrated by the examples of the US automotive and financial industries); *ii)* divestment strategies carried out by MNES willing to get rid of some of their assets in order to restore their financial situation (as illustrated by the examples of Rio Tinto or Cemex); and *iii)* the fact that some cash rich companies or investment funds will take advantage of these opportunities to boost their international expansion (as illustrated by the examples of Volkswagen or some Chinese manufacturers in a large array of industries).

192. In conclusion, despite a temporary setback in FDI flows, the present crisis might trigger an acceleration in the international restructuring process of IRI, with three major aims: *i)* adjusting better the

[31] This decline is itself imputable to two major causes: due to *i)* a squeeze in financial resources available for purchase operations and *ii)* a decline in the value of the purchased assets due to the crisis on the stock-exchange market.

geographical breakdown of activities to the location of markets; *ii)* taking advantages of the locations offering the best cost/efficiency ratios, for each stage of the companies' value chain, and when a location at the immediate proximity of the market is not necessary ; *iii)* adjusting dynamically the companies' frontiers (both in terms of products and internalisation vs externalisation of various components of its value chain) in order to maximise the profitability/risks policy mix.

5.2 Major strengths and weaknesses of OECD countries for the attraction of IRAs

193. As shown by various studies (UNCTAD, 2009b), OECD countries and emerging economies are characterised by quite different patterns in terms of attractiveness assets (table 12). The former can rely mainly on the size of their regional market, on the quality of their technical and business environment, as well on the efficiency of their public governance. Emerging countries (as well as some recent OECD members in Eastern Europe and Central America) are mostly favoured by the growth of their market and their cheap labour costs.

Table 12. Fifteen most attractive countries for FDI, by factors favouring investment, 2009-2011

(Per cent of responses for a given country)

Host country / Location criteria	Presence of suppliers and partners	Follow your competitors	Availability of skilled labour and talents	Cheap labour	Size of local market	Access to international/ regional market	Growth of market	Access to natural resources	Access to capital market (finance)	Government effectiveness	Incentives	Quality of infrastructure	Stable and business-friendly environment
China	10	6	7	11	19	9	21	2	2	3	3	3	4
United States	11	5	10	1	17	8	9	3	7	7	1	9	13
India	11	5	11	13	19	9	24	1	1	1	1	1	3
Brazil	10	3	6	9	20	10	19	3	2	2	4	3	8
Russian Federation	11	7	1	2	31	9	31	3	-	-	3	1	1
United Kingdom	9	4	12	-	17	10	9	2	7	6	-	11	14
Germany	12	5	13	-	21	11	7	1	3	5	1	12	11
Australia	9	3	4	1	14	8	9	12	4	9	3	11	12
Indonesia	10	5	7	13	16	10	20	15	-	2	-	-	3
Canada	10	3	9	-	19	6	12	4	6	7	1	9	14
Viet Nam	10	6	6	16	14	6	22	2	2	4	4	2	8
Mexico	9	2	12	9	19	16	16	5	-	-	2	2	7
Poland	8	5	5	5	24	11	26	5	-	3	3	3	3
France	13	4	11	-	18	9	11	2	-	4	2	13	11
Thailand	10	-	10	10	8	12	20	2	4	-	6	10	8
World average	10	5	8	6	17	10	16	4	3	5	2	6	9

Source: UNCTAD, 2009b

194. Three findings however show that some of the competitive margin of OECD economies might be not as important as it could be expected for some key location criteria.

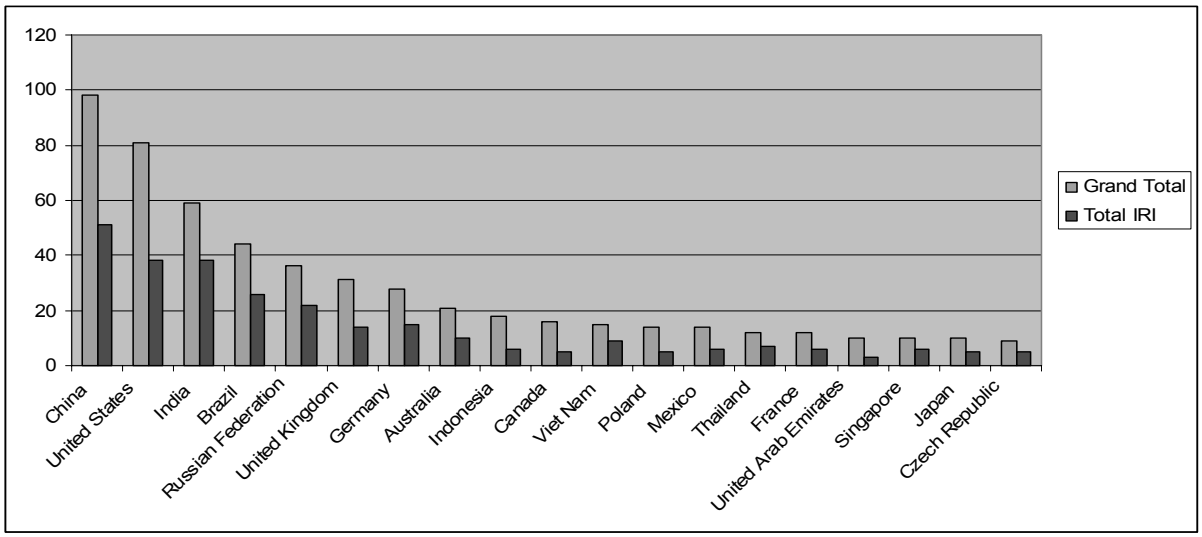
195. First, some of the largest emerging economies, such as China or Brazil, are ranked high by MNEs, in terms of future market growth as well in terms of actual market size. This is coherent with the fact that MNEs increasingly aim at developing their activities in these countries not for costs reasons, but in order to access to their large and expanding markets (JBIC, 2008). In the meantime, new low-wages countries such as Vietnam are the focus a growing interest from MNEs for efficiency-seeking reasons.

196. Second, some emerging economies, like India, are already considered as very attractive in terms of skills and talents. This finding is very important, as it shows that one of the supposedly major competitive assets of OECD countries might be increasingly challenged by other destinations.

197. Third, and consequently, emerging countries are quite well ranked in investor's view for the location on innovation-intensive industries (figure 7). This confirms once again the importance of risks and challenges to which OECD countries are confronted to in these activities.

Figure 7. Countries attractiveness rankings, IRA and all industries

(Number of responses to the survey)



Source: UNCTAD 2009b

5.3 Some implications in terms of economic and development policies

198. As shown by the present study, the attraction of international investment has now become a major stake for the development of IRA in OECD, as companies in all of these activities are highly internationalised and have set up cross border networks for the conception, production and distribution of their product. They locate each components of their value chain in the countries/regions offering the best competitive advantage in order to optimise the overall cost/efficiency mix of these value chains.

199. This involves a fierce competition between potential host countries for the location of new projects and the preservation of existing sites. The on-going economic and financial crisis has dramatically sharpened this competition as companies accelerate the restructuring of their existing networks in order to save costs and adjust to the evolution of markets. As a consequence, a wave a divestments has recently been observed, involving the closing of many sites and layoffs, especially in developed countries, while the flow of new projects is slowing down.

200. In addition, industrialised countries are faced to a growing competition by emerging economies for the location of new activities in IRA. This growing attractiveness of emerging markets is not only related, as some years ago, to cheaper labour costs, but also to the existence of large and fast growing markets, and, increasingly of large polls of skilled manpower. Consequently it does not only affects the most labour-intensive, low value added components of the value chain, but, increasingly, more innovative and technology intensive activities - even if large OECD countries remain by far dominant in terms of R&D activities.

201. In order to avoid a further dwindling of their competitive advantage for the location of innovation-intensive activities, OECD countries must implement initiatives aimed at offering to companies a favourable environment for the development of their business. The findings of the present study regarding the location criteria for international projects may provide a road-map to assess the major priorities of these policies.

202. First, market seeking remains by far the major location motives - including for R&D activities which often have to be carried in close interaction with the major customers - it thus seems appropriate to stimulate the conditions for the growth of local markets for IRA. These initiatives may include the launching of large public equipment or development programmes (for instance in telecommunications, space, military equipment), the creation of favourable market conditions (for instance regarding the pricing of drug), or the development of new infrastructures favouring the local development of new customers needs and consequently of innovative supply (as was experienced in the 80's with the internet in the US and in the 90's with broadband telecommunication in some Asian countries).

203. Second, the overall openness of a country to international investment appears to be an important location determinant in IRI. Anti-FDI protectionism should thus not be considered as a political option (UNCTAD/OECD/WTO, 2009). On the opposite way, OECD countries should implement targeted policies aimed at attracting investment in innovation-oriented activities, as has already been done by many of them (box 4).

204. Third, the existence of large scientific infrastructure and an efficient national innovation system is an important requisite for the location of R&D activities. OECD government should thus encourage more students to engage in research careers in scientific and technological fields (grants, entry-level research positions), promote the development of technological clusters offering a favourable environment for the launching of innovative projects (including through partnership), encourage R&D efforts in businesses (fiscal incentives,..), favour the creation of stronger links between public research laboratories and private business (R&D outsourcing, mobility of public researchers), strengthen the tolls aimed at financing innovation in SMEs and start up, etc.

205. Fourth, the wage costs plays an important role in the location of the most labour intensive activities (mostly, but not only, in low-value added segments). Any initiative aimed at limiting unnecessary costs should be welcomed, in IRA as in other industries. In particular, the question of the financing of social security systems should be addressed taking in consideration its impact of local businesses and workers competitiveness. Consequently, any initiative aiming at reducing its burden on wage cost should be welcomed.

206. Fifth, the location decisions regarding foreign activities in IRI are quite sensitive to the government efficiency. Any public initiative favouring the development of local businesses (including in particular the quality of local government and infrastructures, the decrease in red tape, an increased transparency and shorter delays in public decisions) will play a positive role in this regard.

Box 4. Some examples of targeted promotion policies implemented by OECD countries in innovation-intensive activities

In the Netherlands, The ministry of economic affairs has announced at spring 2006 a restart and a reorientation of its attractiveness policy in order to cope with the declining attractiveness of the country in traditional manufacturing activities**.** This initiative bear consequences in the following fields: 1) an increased promotion effort in activities where the Netherlands can take profit of strong assets, especially in fields where innovation is a major stake ; 2) and an increased focus on after-care, in order to face the risks of relocation of existing activities.

In Ireland, The Irish Development Agency (IDA) has gradually re-oriented during the 20 last years its attraction policy towards innovation-related and higher added activities, to the prejudice of traditional manufacturing activities, such as automotive and electronic assembly plants. The location of this later kind of activities had been major driving force of the initial industrial development process of the country in the 60's; but, as wages were increasing in Ireland, these projects have been progressively diverted to more attractive destination in terms of costs. By refocusing its promotion activities, Ireland has been able to take advantage of the rising wave of projects in call centres and shared services centres, as well as in ICT (software…). In the most recent years, it has developed successful promotion activities in such fields as biotechnologies, R&D centres, and finance management centres. The attraction of higher value added activities has thus made up for the relocation of labour-intensive industries, and has played a great part in the upgrading of the Irish economy as a whole. Consequently, the country position has evolved in 50 years from the situation of a semi-developed rural economy to that of a "high tech" economy the per-capita income of which are among the highest in Europe.

In Sweden, the Invest in Sweden Agency presently focuses its promotion activity on some key-sectors, most of them related to innovation: health, ICT (especially mobile telecommunications), activities related to the wood value-chain.

In France, the attraction of IRA is one of the major components of the attractiveness policy set up by the government since 2004. Among the 130 measures implemented since then, more than 30 are directly aimed at improving the attractiveness of the country for skills and talents (visiting fellowship programmes for high levels foreign researchers, adapted cursus for foreign students), as well as for decision-making centres and executives (more favourable tax system).Various incentives to R&D efforts have also been implemented or strengthened (clusters development policy, rebate on the corporate tax). Invest in France agency has focused 20% of its promotion efforts on 15 innovation-related segments showing ac high potential, such as new materials or bio-production.

This priority given to IRA in the attractiveness policies can also be observed among the most advanced emerging and transition countries, such as South–Korea, the Czech Republic or Mexico. After having based their industrial policy on the attraction or local development of low then mid-tech manufacturing activities, those countries must now turn to more high-value added segments in order to make up for the decline of their competitiveness in labour-intensive activities, where their suffer in turn from the competition of countries with very low wages levels.

In Northern Mexico, the town of Mexicali, located in the state of Low-California, at the frontier between Mexico and the US, has attracted since the 60's many maquilladoras, with a strong specialisation in the manufacturing of TV screens. But, in the early 90's, it began to be confronted to the emergence of new technologies (such as flat plasma screens) and to the competition of new destinations for investment projects (Asian countries). The result has been a decline in the traditional manufacturing activities of the city. A recovery program has thus been devised in the early 2000's, based on the mastership of more innovative products and technologies: the manufacturing of components and the providing of logistic services are now being given priority as compared to the traditional assembly of TV Sets. On the longer term, the purpose of this policy is to manage a transition from a low-skill, labour-intensive manufacturing economy, to and economy based on services and innovation at all steps of the value chain. This means training programs for workers, upgrading of local suppliers, development of infrastructure, increased promotion efforts for foreign investors (including after-care for those already active in the city). According to the local development authorities, this policy might already have led to some achievements, such as the completion of investment projects in higher value added segments by firms already active in the region, and even by some new companies.

In South Korea, the priority publicised by Invest in Korea is « to help to turn Korea into a regional hub in North-East Asia, acting as a link between the Pacific and continental economies ». The national economy could thus rely upon new sources of growth, while the traditional powerhouse of the South Korean development (*e.g.* exports of low and medium value added manufactured products) is gradually fading off. High value added projects are considered as a priority target.

In Singapore, the attractiveness policy is strongly embedded in the global development model of the country. This model is not any more based in the expansion of manufacturing activities, but in information and knowledge technologies. This is why Singapore makes its best to attract R&D centres and even tertiary teaching activities, preferably to factories.

Source: Hatem, 2008

6. CONCLUSION

207. This study has highlighted the growing importance of MNEs' international location decision for the local development of IRAs, against the background of a quick internationalisation of these activities. In the meanwhile, the attractiveness of the most advanced countries for innovation related investment projects is increasingly challenged by emerging countries, not only for cost reasons, but also due to the quick growth of the latters' local markets and technological capabilities.

208. Using the data on the foreign presence in OECD countries available in the FATS and AFA data bases, this study has identified the size of markets, the agglomeration effects, and the openness of the country to FDI as the major generic location factors for international projects in IRI. In addition, the overall R&D and innovation-intensity of the country play a key role in the attraction of R&D activities of MNEs, while labour costs impact significantly the location decisions for the most labour intensive activities.

209. On the base of these findings, five priorities should be set in the action of OECD government to enhance their countries' attractiveness for international projects in IRI: 1) stimulate the local development of new markets for these activities; 2) foster the overall quality of the national innovation system and of each of its major components (education, R&D financing and incentives, promotion of clusters, public-private partnerships, etc.) ; 3) implement targeted promotion policies in IRA in order to attract new projects - and retain exiting activities; 4) address the question of costs (especially wages costs), in particular through fiscal reforms; and 5) improve the regulatory, administrative and technical business environment.

ANNEX 1.

SOME EVIDENCES ON THE ROLE OF M&AS IN THE INTERNATIONALISATION OF INNOVATION RELATED INDUSTRIES

A. Telecommunication services industry

Since 1995, more than 40 cross-border M&As with a value superior to 5 billion dollars have been registered worldwide in the telecommunication industry. They have been the major driving force in the build up of large multinational companies in this industry, as evidenced by the following four examples:

Vodafone, formed through the introduction on the stock exchange of 20% of Racal electronics, and named Vodafone in 1991, has become the world leader in mobile phone through a very active M&A strategy (acquisition of Air Touch in 1999 and Mannesmann in 2000, then Hutchinson Essar (Hong Kong) in 2007).

France Telecom which has been going through a privatisation process since 1997, has build up its international dimension through the purchase of Orange in 2000, then Auna in Spain in 2005. However, due to a period of financial trouble between 2002 and 2007, following the costly acquisition of Orange, it also had to divest from many companies since 2003 (Eutelsat, Telecom Argentina, Wind telecommunication, Noos, Pages Jaunes, Orange Pays-Bas, etc.).

Deutche Telekom, privatised in 1996, internationalised through the acquisition of One 2 One and Voice stream Wireless in the US, in 1999 and 2001 respectively.

Telefonica (Spain) has acquired Telecommunicacoes de Sao Paulo (Brazil) in 2000 and O2 plc (UK) in 2006.

2. Pharmaceuticals

Most of the largest MNEs active in the pharmaceutical industry have extensively relied upon cross-border M&As to build up their international presence, against the background of a concentration process, as evidenced by the following examples[32]:

Pfizer (USA), after having been very conservative on M&As until 2000, merged with Warner-Lambert (which had formerly acquired Parke Davis in 1970 and Agouron pharmaceuticals in 1999), then acquired Upjohn Pharmacia in 2002[33], and finally Wyeth in 2009.

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32 Many of the information regarding the history of the build-up of large pharmaceutical MNEs through cross-border M&As hav been retrieved from the on-line Wikipedia encyclopedia.

Sanofi Aventis (France) was formed in 2004 when Sanofi-Synthelabo (itself formed by the merger between Sanofi, former subsidiary of Total, and Synthelabo, former subsidiary of L'Oreal, which also acquired Connaught form Pasteur-Merieux) acquired Aventis (formed by the merger of Rhone-Poulenc and Hoescht-Marion-Roussel, itself formed from the merger of Hoeschst, Roussel Uclaf and Marion Merrel Dow).

Johnson & Johnson (USA) was founded in 1886 as a company specialised in the production of bandages: It has then pursued a steady diversification since the 1900s, notably into consumer products (in the 1920s) and surgical products (in the 1940s). It also expanded into pharmaceuticals with the purchase of McNeil Laboratories, Inc., Cilag, and Janssen Pharmaceutica, and into women's sanitary products and toiletries in the 1970s and 1980s. In recent years, Johnson & Johnson has expanded into such diverse areas as biopharmaceuticals, orthopedic devices, and Internet publishing. In 2006, Johnson & Johnson has purchased Pfizer's Consumer Healthcare department.

Astrazeneca (Sweden) was formed in 1999 as a merger of Swedish Astra and UK Zeneca, the former pharmaceutical unit spun off in 1998 from ICI, which has long ago built its own pharmaceutical business through the acquisition of US firms. In the recent years, it has set up a large network of partnerships : with Astex for anti-cancer agents (2005), with Avanir on anti-cholesterol (2005), with Schering AG on selective glucocorticoid receptor agonists (2005), with Abbott Laboratories for the development of Crestor and TriCor (2006), with Bristol-Myers Squibb on investigational drugs (2007). It also acquired some companies, such as Cambridge Antibody Technology (2006) and MedImmune (2007).

GSK (UK) was formed in 2000 by the merger of Glaxo wellcome (itself formed in 1995 by the merger of Burroughs Wellcome (UK) and Glaxo Laboratories (New Zealand, then US) and Smithkline Beecham[34].

Bayer (Germany) had already assets abroad in Europe and North America before 1914, but they were confiscated during WWI. With a few exception, such as the purchase of Miles Laboratories and 1978, it did not implement many cross-border M&as before the 90's. But things then changed somewhat, as, in 1994, Bayer AG purchased Sterling Winthrop's drug business from SmithKline Beecham and merged it with Miles Laboratories: It thereby reacquired the U.S. and Canadian trademark rights to "Bayer", as well as the ownership of the Aspirin trademark in Canada.

Novartis was formed in 1996 from the merger of Ciba Geigy (itself formed form the merger of the two eponym companies in 1971) and Sandoz laboratories. Novartis combined its agricultural division with that of AstraZeneca to create Syngenta in November 2000. In 2006, Novartis acquired the California-based Chiron Corporation.

AkzoNobel (Sweden) has a long and very rich history of mergers and divestments. Parts of the current company can be traced back to 17th century companies. The milestone mergers and divestments are the formation of AKZO in 1969, the merger with Nobel Industries in 1994 forming Akzo Nobel, the divestment of its pharmaceutical business[35] and the merger with ICI in 2007/2008 resulting in current day AkzoNobel. Since 1994 onwards, the company has implemented not less than 40 M&A and divestment operations.

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33 Pharmacia & Upjohn Pharmacia was itself formed through the merger of Upjohn Pharmacia and Searle, followed by the acquisition of SUGEN.

34 Formed in 1995 from Beecham (UK) and Smithkline (US), Smithkline Beecham began to expand globally in the 1960's. It also bought international Clinical Laboratories in 1988.

35 Which now make AkzoNobel more a chemical company than a pharmaceutical one:

3. Electronics and software

Historically, cross-border M&As have not been used as extensively in these industries as in pharmaceuticals. However, some companies, such as Philips and Sony, have a long record of using M&As as a major internationalisation modality.

Philips (The Netherlands) has a long record of external growth through M&As. Companies acquired by Philips through the years include Amperex, Magnavox, Signetics, Mullard, VLSI, Agilent Healthcare Solutions Group, Marconi Medical Systems, ADAC Labs, ATL Ultrasound, portions of Westinghouse Optiva Corporation, as well as the consumer electronics operations of Philco and Sylvania. Among the most recent operations are the acquisition of Lifeline Systems (2006, US), Ximis (2007, US), and Respironics (2007, US). In October 2007, it purchased a Moore Microprocessor Patent (MPP) Portfolio license from the TPL Group. But it has also filialised and sold its semi-conductors units, renamed NXP, to a consortium of investors (mainly foreign) in 2006.

Sony (Japan/USA) has also used extensively cross-border M&As and partnerships. After it alliance with Philips in CDs in 1982, it diversified to audio contents through the purchase of CBS Records Group in 1987, which was renamed "Sony Music Entertainment" in 1991 and merged with BMG in 2004. It acquired Columbia Pictures Entertainment, renamed "Sony Pictures Entertainment" in 1991. It also created many JV, in entertainment as well as in electronics (with Toyota industries in liquid crystal display in 1997; with Ericson in mobile phone in 2001; with Samsung electronics in LCD in 2004; with NEC in 2006 in optronics, with NXP in electronic components in 2007). It acquired MGM and United Artists (in 2005) and various start up in video games, as well as the Digital Single Lens Reflex cameras section from Konica Minolta in 2007.

Since 1995, the use of M&As has considerably grown in the electronics and software industries. 12 major cross border M&As with a value superior to 5 billion dollars have been recorded: Among the major ones – in addition to those mentioned above - were:

- The purchase of the computer peripheral equipment maker BCE (Canada) by Bay Network (USA) in 1998.
- The purchase of electronic components company AMP by Tyco International (Bermuda) in 1999.
- The merger between HP and Compaq in 2002 (Compaq had formerly bought Digital Equipment corp.) then with EDS in 2008.
- The merger between the mobile networks division of Siemens and Nokia's Network business group in 2006:
- The merger between Alcatel and Lucent in 2006.
- The purchase of software maker NAVTEQ (USA) by Nokia (Finland) in 2008.

ANNEX 2.

SOME ADDITIONAL ECONOMETRIC RESULTS

Table A2.1. Determinants of foreign-controlled value added location in OECD countries (additional results)

	VA_i	VA_i/PIB	PIBPOT	FRAT	ENVT	HQ+MQ	EDUC	PIB	C	OBS.	LK FCT	ADJ R2
C15tT7		1.2 (0.5)**	1.6 (0.5)***	0.4 (0.1)***					-29.0 (10) ***	168	14.6	0.97
C24 M2423			1.1 (0.3) ***	0.2 (0.0) ***	-0.1 (0.0)**				-16.* (5.2)***	38:6	71	0.98
C2423		1 (0.4) ***	1.4 (0.3) ***	0.3 (0.2) *	-0.1 (0.1)		0.1 (0.4)		-22.5 (5.1) ***	74	18.7	0.98
C29t33		1.0 (0.4)**	1.3 (0.2)***	0.1 (0.1)					- 21.8 (8.1)***	73	32.2	0.98
C29		0.4 (0.2) **	1.7 (0.3) ***		-0.2 (0.1)				-22.2 (4.9) ***	119	-39.8	0.92
C30t33		0.3 (0.2)*	0.9 (0.2)***	0.3 (0.2)*					-9.8 (4.4)**	85	12.1	0.96
C30	0.3 (0.8)								-0.7 (17.5)	95	- 139.7	0.64
C31		0.2 (0.4)	0.5 (0.6)	1 (0.5)**	- 0.1 (0.2)				- 5.3 (9.6)	102	- 60.8	0.84
C32		0.7 (0.4) *	0.7 (0.6)	0.3 (0.5)	-0.2 (0.2)				- 11.2 (10.8)	95	- 51.4	0.89
C33		0.8 (0.3) ***	1.5 (0.2) ***	0.4 (0.1) ***	0.0 (0.1)				-24.7 (3.9) ***	91	7.2	0.97
C34		0.9 (0.4) ***	1 (0.4) **	1.4 (0.4) ***	0.0 (0.2)				- 19.2 (6.5) ***	88	- 54	0.91
C352		1.1 (0.2) ***		1.7 (0.9) *	- 0.2 (0.7)			2.6 (2.7)	- 45.0 (36.6)	28	- 17.2	0.94
C64			2.2 (0.6) ***	1.4 (0.6) **	- 0.8 (0.6)				- 30.4 (7.1) ***	41	- 7.2	0.82
C65T67		0.6 (0.0)***	2.5 (0.0)***	1.8 (0.0)***					- 34.6 (0.0)***	11	43.0	0.95
C72		1.4 (0.2) ***	1.2 (0.3) ***	0.4 (0.3)		33 (1.1) ***			- 20.3 (2.6) ***	75	- 42.5	0.92
C73		05 (0.1) ***	2.9 (1.0) ***	0.2 (0.5)	- 0.1 (0.5)				37.2 (13.5) ***	64	- 45.8	0.92
C74		0.2 (0.2)	1.7 (0.3)***	0.7 (0.2)***					- 19.4 (5.4)***	88	- 59.98	0.87

Standard deviation between brackets. *: 10% significant. **: 5% significant. ***: 1% significant.

Table A2.2. Determinants of foreign-controlled R&D expenditures location in OECD countries (additional results)

	VA_i	RD_i	RD_i/VA_i	VA_i/PIB	VAE_i/VA_i	PIBPOT	ENVT	PCT	RD/PIB	C	OBS.	LK FCT	ADJ R2
C15T37			1.1 (0.3) ***	0.8 (0.4) **	1.1 (0.2) ***	1.0 (0.2) ***	0.0 (0.0)			17.7 (5.0) ***	54	28.0	0.99
C24m2423			0.5 (0.3) *	0.8 (0.7)	1.0 (0.3) ***	0.6 (0.4)			1.0 (0.6) *	11.1 (9.5)	54	- 3.9	0.97
C2423			0.5 (0.3)*	0.6 (0.2)***	1.6 (0.05)***	1.7 (0.1)***				5.8 (3.4)*	61	- 19.2	0.98
C29t33				0.8 (0.4)*	0.7 (0.6)	1.2 (0.5)***			0.4 (0.8)	- 10.6 (17.1)	61	- 15.2	0.95
C29	1.0 (0.3) ***		0.5 (0.2) ***		1.0 (0.1) ***	0.3 (0.6)					70	- 19.2	0.96
C30t33			0.2 (0.3)	1.0 (0.4)**	0.9 (0.2)***	2.1 (0.4)***				-19.5 (6.7)***	50	1.2	0.94
C30			0.5 (0.3)*	1.1 (0.7)	1.4 (0.3)***	1.4 (1.8)				1.4 (26.7)	48	-65.8	0.89
C31			0.8 (0.5)	1.3 (0.9)	1.2 (0.1)***	1.6 (0.6)**				1.0 (14.3)	58	-49.5	0.91
C32		0.3 (0.4)	1.0 (0.3)***	1.3 (0.3) ***	0.4 (1.1)					7.4 (13.5)	53	- 46.9	0.92
C33			1.7 (0.5) ***	1.9 (0.6) ***	1.4 (0.5) ***	3.0 (1.2) **	- 0.1 (0.2)			- 7.4 (12.7)	41	36.2	0.92
C34			1.1 (0.4)***	1.1 (0.2)***	1.5 (0.1)***	1.9 (0.3)***				6.0 (4.8)	54	- 27.99	0.95
C352			0.1 (0.1)	0.1 (0.2)	0.1 (0.0) ***	1.0 (0.1) ***		0.2 (0.1)		- 13.13.4) ***	14	27.4	0.996
C64		NA	NA	NA	NA	NA	NA	NA	NA	NA			NA
C65T6		NA	NA	NA	NA	NA	NA	NA	NA	NA			NA
C72		NA	NA	NA	NA	NA	NA	NA	NA	NA			NA
C73		NA	NA	NA	NA	NA	NA	NA	NA	NA			NA
C74		NA	NA	NA	NA	NA	NA	NA	NA	NA			NA

Standard deviation between brackets. *: 10% significant. **: 5% significant. ***: 1% significant.

Table A2.3. Determinants of foreign-controlled employment location in OECD countries (additional results)

	FRAT	HQ+MQ	ENVT	INDSSAL	VAE_i	EDUC	C	OBS.	LK FCT	ADJ R2
C15T37				- 0.2 (0.1) **	0.5 (0.1) ***	0.0 (0.1)	6.7 (1.1) ***	151	142.9	0.99
C24 M2423			-0.1 (0.0)	- 0.3 (0.2)		0.1 (0.2)	8.3 (0.5 ***	82	89.2	0.995
C2423				- 0.8 (0.1) ***	0.7 (0.1) ***		3.5 (0.4) ***	109	43.7	0.99
C29t33			- 0.2 (0.1)*	-0.6 (0.1) ***	0.5 (0.1) ***		6.7 (0.7) ***	78	86.6	0.99
C29				- 0.7 (0.0)***	1.0 (0.0) ***	0.2 (0.1)	2.6 (0.2) ***	141	- 11.2	0.95
C30t33				- 0.9 (0.2) ***	0.6 (0.1) ***	0.0 (0.1)	5.7 (0.9) ***	101	85.3	0.99
C30				- 0.8 (0.3) ***	0.8 (0.1) ***		3.8 (0.4) ***	103	- 28.2	0.94
C31			- 0.1 (0.1)	- 1.5 (0.3) ***	0.7 (0.0) ***		4.1 (0.2) ***	108	20.1	0.97
C32			- 0.2 (0.1)	- 1.3 (0.2) ***	0.6 (0.1) ***		4.7 (0.4) ***	100	38.8	0.98
C33		0.1 (0.4)	- 0.2 (0.0) ***	0.0 (0.2)	0.4 (0.1) ***		6.0 (4.1) ***	85	60.0	0.99
C34			- 0.1 (0.1)	- 1.0 (0.1) ***	0.8 (0.0) ***	0.0 (0.1)	3.9 (0.4) ***	94	40.6	0.99
C352			0.0 (0.2)	- 0.1 (0.2)	0.8 (0.0) ***		3.5 (0.3) ***	35	21.2	0.99
C64				- 1.5 (0.6) ***	0.9 (0.1) ***	0.8 (0.3) **	0.4 (0.6)	38	12.1	0.91
C65T67	1.0 (0.4) **	8.7 (0.6) ***	- 0.8 (0.1) ***		0.3 (0.1) ***		- 34.0 (2.2)	17	9.2	0.98
C72				- 0.1 (0.3)	0.6 (0.1) ***	0.4 (0.2) **	5.1 (0.6) ***	80	9.4	0,97
C73				- 0.5 (1.7)	1.2 (0.2) ***	1.3 (2.0)	- 0.6 (2.9)	66	- 96.0	0.83
C74		0.1 (0.5)	- 1.0 (0.3) ***	0.7 (0.1) ***			4.6 (1.7)***	74	- 3.3	0.94

Standard deviation between brackets. *: 10% significant. **: 5% significant. ***: 1% significant.

Table A2.4. Determinants of FDI location in OECD countries (additional results)

	VA_i	VA_i/PIB	PIBPOT	FRAT	ENVT	$KSTO_i$	C	OBS.	LK FCT	ADJ R2
C15t37			0.4 (0.2)*	0.8 (0.1)***		0.6 (0.3)**	- 5.2 (1.6)***	163	79.7	0.99
C24 M2423		0.9 (0.2)***	1.2 (0.2)***	0.6 (0.0)***			- 20.6 (3.3)***	49	23.3	0.99
C2423		0.7 (0.7)	1.3 (0.3) ***	0.4 (0.0) ***			- 20.6 (9.0) **	53	7.3	0.99
C29t33		0.9 (0.5)*	0.4 (0.3)	0.8 (0.1)***			- 10.0 (3.1)***	56	27.9	0.99
C29			0.6 (1.2)***	0.7 (0.3)***	- 0.1 (0.1)	1.3 (0.5)***	- 16.2 (13.0)	48	- 16.2	0.88
C30t33	0.1 (0.4)		0.3 (0.8)	0.7 (0.1)***			- 2.7 (4.0)	56	7.2	0.98
C30	0.4 (0.3)		0.4 (1.4)	1.3 (0.4)***	- 0.1 (0.4)		- 13.4 (17.7)	109	- 132.6	0.91
C31	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
C32		0.9 (0.3)***	0.6 (0.4)	1.2 (0.2)***	- 0.4 (0.2)*		- 13.2 (5.7)**	113	- 73.8	0.95
C33			2.7 (1.0)***	0.1 (0.3)			- 34.7 (15)**	83	- 83.4	0.94
C34		0.4 (0.8)	2.3 (0.8)***	0.0 (0.6)			- 31.4 (11.3)	177	- 261.0	0.79
C352		0.2 (0.2)	3.2 (1.4)**	0.2 (0.7)	- 0.5 (0.2)		- 46.8 (18.3)**	23	10.8	0.995
C64		9.1 (3.4) **	18.7 (3.9)***				- 238.6 (50)**	26	- 38.2	0.73
C65T67			0.7 (0.3)***	1.4 (0.2)***	- 0.2 (0.0)***	0.3 (0.4)	- 8.0 (1.5)***	94	6.1	0.97
C72		0.2 (0.3)	2.7 (0.6)***	1.2 (0.2)***	0.3 (0.2)		36.6 (8.6)***	50	- 17.0	0.95
C73		0.2 (0.0)***	2.2 (1..2)*	1.2 (0.5)***	1.7 (0.6)***		- 30.8 (17.2)*	38	- 26.2	0.95
C74	0.1 (0.9)		2.0 (0.1)***				2.2 (0.9)**	59	- 36.9	0.93

Standard deviation between brackets. *: 10% significant. **: 5% significant. ***: 1% significant.

Table A2.5. Determinants of foreign-controlled foreign subsidiaries location in OECD countries (additional results)

	PIBPOT	FRAT	ENVT	NE_i	C	OBS.	LK FCT	ADJ R2
C15T37		0.5 (0.1)***	- 0.1 (0.1)	0.0 (0.1)	5.1 (1.3)***	47	- 16.0	0.92
C24 M2423	0.1 (0.1)	0.2 (0.1)**	- 0.1 (0.0)	0.2 (0.1)*	2.0 (1.9)	86	56.5	0.97
C2423	- 0.2 (0.2)	0.3 80.2)	0.0 (0.2)	0.7 (0.1)***	1.1 (2.1)	86	32.0	0.98
C29t33	0.8 (0.3)***	0.1 (0.1)*	- 0.1 (0.1)	0.1 (0.1)	- 7.6 (4.2)*	94	28.3	0.96
C29	0.4 (0.2)*	0.4 (0.1)***	- 0.1 (0.0)***	0.1 (0.1)	- 2.2 (2.7)	129	44.5	0.97
C30t33	1.1 (0.5)**	0.2 (0.1)**	- 0.1 (0.1)	0.1 (0.1)	- 12.2 (7.6)*	94	- 67.8	0.76
C30	0.1 (0.3)			0.1 (0.1)	1.1 (4.0)	145	- 24.6	0.94
C31	0.2 (0.3)	0.2 (0.1)**		0.3 (0.1)**	- 1.5 (3.5)	163	- 8.0	0.92
C32	0.4 (0.2)**	0.5 (0.2)***	- 0.1 (0.2)	0.1 (0.1)**	- 4.6 (3.5)	116	- 1.4	0.92
C33	0.8 (0.4)**	0.3 (0.1)***	- 0.2 (0.1) ***	0.1 (0.1)	- 9.6 (4.9)**	114	8.9	0.96
C34	0.7 (0.2)***	0.3 (0.1)***		0.3 (0.3)	- 10.2 (3.3)***	152	- 4.7	0.96
C352	0.5 (0.3)*	0.3 (0.2)		0.2 (0.2)	- 8.0 (3.7)**	97	- 6.3	0.95
C64	NA	NA	NA	NA	NA	NA	NA	NA
C65T67	NA	NA	NA	NA	NA	NA	NA	NA
C72	NA	NA	NA	NA	NA	NA	NA	NA
C73	NA	NA	NA	NA	NA	NA	NA	NA
C74	NA	NA	NA	NA	NA	NA	NA	NA

Standard deviation between brackets. *: 10% significant. **: 5% significant. ***: 1% significant.

ANNEX 3.

TABLES AND FIGURES

Table A3.1. Share of foreign control in turnover for a selected sample of OECD countries and industries, 1991-2006.

Year		1991	1992	1994	1995	1997	1999	2000	2003	2004	2005	2006
Czech republic	Total machinery and equipment	..	..	..	..	..	..	40.8	59.9	65.2	63.4	63.9
	Motor vehicles	..	..	..	..	70.5	81.3	88.8	90.5	93.1	93.4	91.7
Finland	Total machinery and equipment	..	..	..	..	..	18.7	..	..	..	13.2	..
	Motor vehicles	..	..	6.7	..	..	..	17.1	..	..	29.7	34.8
	Post and telecommunications	..	..	..	..	..	..	..	..	..	..	..
France	All chemical products	..	..	44.5	46.1	45.4	44.6	44.6	45.4	45.8	45.8	42.2
	Total machinery and equipment	..	..	42.2	44.9	48.5	50.4	50.7	48.9	47.1	45.9	44.1
	Motor vehicles	..	..	16.7	18.4	14.5	13.2	15.1	15.6	12.4	13.4	13.8
Germany	All chemical products	25.5	25.5	19.8	19.8	20.7	16.1	9.1	47.7	..	54.3	55.2
	Total machinery and equipment	14.4	14.6	12.1	13.1	11.1	10	12.4	25.8	..	26.3	24.9
	Motor vehicles	20.7	21.1	22	20.1	18.8	9.3	8.5	17.4	17.5	17.8	17.2
Japan	All chemical products	..	3.5	5.1	3.9	5	4.7	4.7	5.5	5.8	..	..
Netherlands	Motor vehicles	..	..	..	25.2	10.5	33.1	36.6	..	77.7	76	..
Norway	All chemical products	..	..	..	..	..	41.8	..	..	..	..	38.5
	Total machinery and equipment	..	..	..	..	29.8	..	..	..	..	..	40
	Motor vehicles	..	..	..	..	8.5	21.1	..	..	..	..	32.4
Poland	All chemical products	..	..	..	..	13.4	24	21.8	29.4	28.9	30.2	..
	Total machinery and equipment	..	..	..	..	23.1	40.1	45.1	54.6	54.7	53.6	..
	Motor vehicles	..	..	..	..	46.3	85.9	86.4	88.3	90.8	86.6	86.2
	Motor vehicles	..	..	..	..	41.5	26	26.9	68.8	84.4	84.1	..
Spain	Motor vehicles	..	..	..	..	..	70.1	81.1	75.3	73.3	73.7	74.3
Sweden	All chemical products	30.3	28.7	36.8	49.5	45.5	62.1	64	72.9	65.9	74.8	76.5
	Total machinery and equipment	35	33	25.4	28.9	18.5	17.9	24.7	32.1	30.5	34.1	34.5
	Motor vehicles	2.8	4.1	2.7	4.7	5.5	45.2	54.2	53	54.3	54.5	52.5
Turkey	All chemical products	..	15.9	16.9	18.9	19.1	19	22.1	..	..	..	..
	Total machinery and equipment	..	13.3	19.8	22	26.2	30.5	27.7	..	..	..	..
	Motor vehicles	..	35.7	36.2	34	34	37.7	48.4	..	..	..	..
United Kingdom	All chemical products	..	..	..	..	40.8	..	..	53.1	53.6	53.9	47.1
	Total machinery and equipment	..	..	..	..	43.4	..	..	50.3	45.9	46.5	48.1
	Motor vehicles	..	..	..	..	73.3	..	..	70.5	81.8	80.9	85

Source: OECD, AFA data base

Table A3.2. Share of foreign control in R&D expenditures for a selected sample of countries and industries[36], 1985-2006

Year		1985	1990	1995	2000	2005	2006
Sweden	Manufacturing	..	14.5	19	35.8	49.4	..
	All chemical products	..	8	34	94.5	94.3	..
	Chemical products	..	7.2	34.1	95.5	95.5	..
	Drugs and medicines	..	0.1	30.3	99.5	98	..
	Total machinery and equipment	..	28.8	19.8	7.7	25.5	..
	Non-electrical machinery and equipment	..	38.7	49.9	38.4	42.4	..
	Machinery and equipment n.e.c.	..	45.7	50	38.7	43.9	..
	Office, accounting and computing machinery	..	17.2	48.4	32.1	11.6	..
	Electrical machinery and electronic equipment	..	23	7	3.2	15.3	..
	Electrical and optical equipment	..	21.5	13.3	6.2	19.4	..
	Electrical machinery and apparatus n.e.c.	..	74	90.6	57.5	86.8	..
	Radio, TV and communication equipment	..	12.2	1.2	0.5	3.5	..
	Medical, precision, opt. instruments	..	7.9	38.2	50	37.9	..
	Motor vehicles	..	0.2	0.9	64.1	52.9	..
Unted Kingdom	All chemical products	..	..	25.7	..	39.8	35.2
	Chemical products	..	..	28.2	33.1	39.4	37.6
	Drugs and medicines	..	..	27	33.3	39.7	37.1
	Total machinery and equipment	..	..	27.6	36	48.1	48.2
	Non-electrical machinery and equipment	..	..	32.5	30.9	43.1	45.7
	Machinery and equipment n.e.c.	..	..	23.2	28.7	43.4	46
	Office, accounting and computing machinery	..	..	68.7	44.2	39.7	36.7
	Electrical machinery and electronic equipment	..	..	24.3	38.9	51.4	50
	Electrical and optical equipment	..	..	31.2	32.9	50.8	48.5
	Electrical machinery and apparatus n.e.c.	..	..	17.6	15.4	34.7	25.1
	Radio, TV and communication equipment	..	..	29.7	48.5	60.1	64.2
	Medical, precision, opt. instruments	..	..	37.6	12.1	51	45.3
	Motor vehicles	..	..	61.5	73.4	87.9	87
	Aircraft and spacecraft	..	..	11.6	12	19.6	30.6
	Computer and related activities	..	..	55.4	30.4	44.2	41.3
	Research and development	..	..	14.6	11.9	30.4	32.1
	Other services	..	..	7.1	8.3	..	7.1
United States	Manufacturing	5.9	11.4	15	16.5	13.5	14.5
	Chemical products	30.8	39.4	46.9	35.1	23	27.5
	Drugs and medicines	16.2	37.7	50.9	46.5	25	29.6
	Total machinery and equipment	5	10.8	14	18.5	..	6.8
	Machinery and equipment n.e.c.	..	14.4	10.7	26.6	18.2	8
	Electrical machinery and apparatus n.e.c.	..	11.5	26.8	22.8	..	58.3
	Medical, precision, opt. instruments	1.2	6	5.8	..	11.4	11.9
	Motor vehicles	..	0.7	2.1	16.8	22.8	21.3

Source: OECD, AFA and FATS data bases

[36] Selection based on the availability of time series.

Table A3.3. Inward FDI stocks by host regions for selected industries, 1990 and 2007

(Percent)	1990		2007	
	Developed	**Developing**	**Developed**	**Developing and transition**
All industries	81.3%	18.7%	73.8%	26.2%
Chemicals and chemical products	72.3%	27.7%	85.9%	14.1%
Machinery and equipment	83.7%	16.3%	86.4%	13.6%
Electrical and electronic equipment	79.6%	20.4%	69.1%	30.9%
Precision instruments	95.9%	4.1%	96.0%	4.0%
Motor vehicles and other transport equipment	85.1%	14.9%	85.7%	14.3%
Transport, storage and communications	55.1%	44.9%	71.8%	28.2%
Finance	75.2%	24.8%	80.8%	19.2%
Business activities	88.0%	12.0%	52.5%	47.5%
Total IRI	77.8%	22.2%	71.0%	29.0%

Source: UNCTAD FDI data base

Table A3 4. Outward FDI stocks by host regions in selected industries, 1990 and 2007

(Percent)	1990		2007	
	Developed	**Developing**	**Developed**	**Developing and transition**
All industries	98.9%	1.1%	88.1%	11.9%
Chemicals and chemical products	99.9%	0.1%	99.4%	0.6%
Machinery and equipment	100.0%	0.0%	99.6%	0.4%
Electrical and electronic equipment	99.9%	0.1%	96.5%	3.5%
Precision instruments	100.0%	0.0%	100.0%	0.0%
Motor vehicles and other transport equipment	100.0%	0.0%	99.8%	0.2%
Transport, storage and communications	98.8%	1.2%	89.6%	10.4%
Finance	98.6%	1.4%	92.2%	7.8%
Business activities	98.5%	1.5%	71.2%	28.8%
Total IRI	**98.9%**	**1.1%**	**87.1%**	**12.9%**

Source: UNCTAD FDI data base

Table A3.5. IRI companies: an important component of the large TNCs universe

% of total	100 non financial TNCs		5000 Companies	
Industry	Number	TNI	Number	Foreign assets
Chemicals exc. pharmaceuticals	3	67.3	5.3	4.7
Pharmaceuticals	9	63.6	2.3	3.8
Machinery and equipment.	0	NA	8.3	2.6
Office and computing machinery	9	57.7	11.5	6.6
Electronic equipments & components				
Precision and medical instruments				
Electrical machinery and apparatus			2.8	0.9
Motor vehicles and trailers	13	56.0	4.3	7.3
Aircrafts and spacecrafts	3	67.7	1.5	6.0
Post and telecommunications	8	70.3	2.4	7.4
Financial intermediation	NA	NA	NA	NA
Computer related activities	2	86.0	11.0	3.7
Research and development				
Other business activities				
Total innovation related industries	47		49.4	43

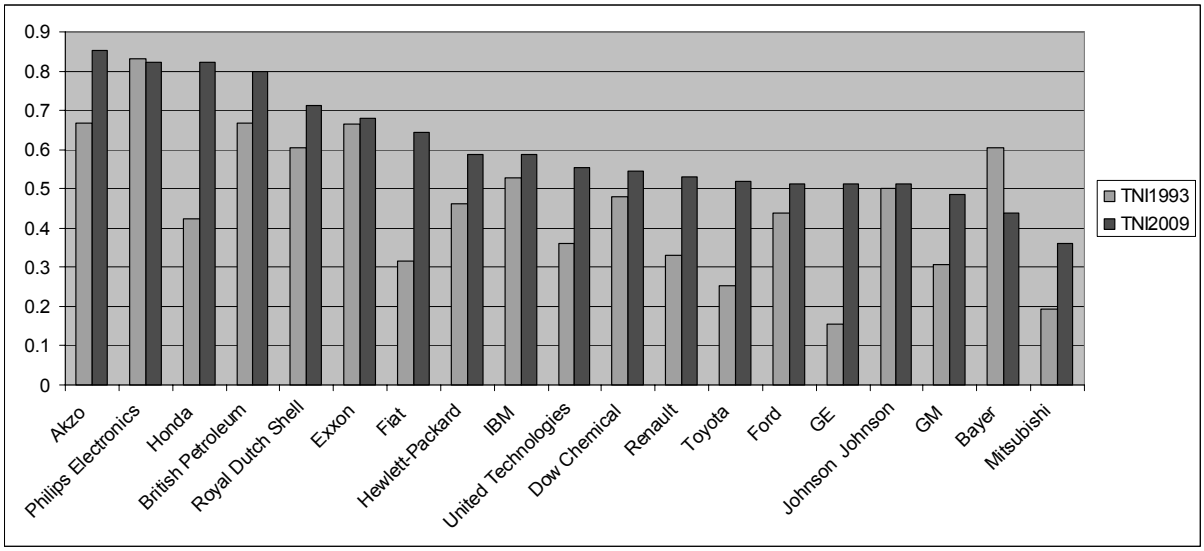
Source: UNCTAD, Thomson Financial

Table A3.6. The 5000 largest MNEs by home region and industry, 2008

	All developed regions						All developing regions				
		North America									
(Percent)	Europe	Canada	United States	Total	Japan	Other developed countries	Total	Developing Asia	Other developing countries	Total	South-East Europe and CIS
					Number of companies						
Chemicals and plastics	29	3	23	26	24	3	82	17	2	18	0
Electrical	30	1	18	18	29	1	78	21	1	22	0
Electronics	16	2	31	33	15	2	66	33	0.3	34	0
Motor vehicles and trailers	28	1	21	22	37	1	89	9	1	9	1.4
Other transport equipment	38	7	18	24	12	3	77	23	0	23	0
Pharmaceuticals	38	4	32	36	8	2	84	16	1	16	0
Machinery and equipment	35	3	27	30	22	1	89	11	1	11	0
Precision instruments	28	2	47	48	11	4	92	8	0	8	0
Business services	37	5	35	40	3	5	86	13	1	14	0
Telecommunications	36	3	26	30	0	6	72	19	8	26	1.7
All business sector	33	4	24	28	12	4	77	20	2	22	0.2
					Foreign assets						
Chemicals and plastics	44	2	37	39	12	2	96	4	0	4	0
Electrical	21	0	15	15	59	0.5	95	5	0	5	0
Electronics	28	1	18	19	27	1	74	26	0	26	0
Motor vehicles and trailers	54	0	12	12	31	0	98	2	0	2	0.1
Other transport equipment	10	0	85	85	4	0	98	2	0	2	0
Pharmaceuticals	62	1	31	31	4	1	98	2	0.1	2	0
Machinery and equipment	40	1	19	20	31	5	96	4	1	4	0
Precision instruments	45	1	40	41	12	1	98	2	0	2	0
Telecommunications	76	0.2	9	9	0	3	89	7	3	10	1
All business sector	53	2	24	26	9	3	91	7	2	9	0.3

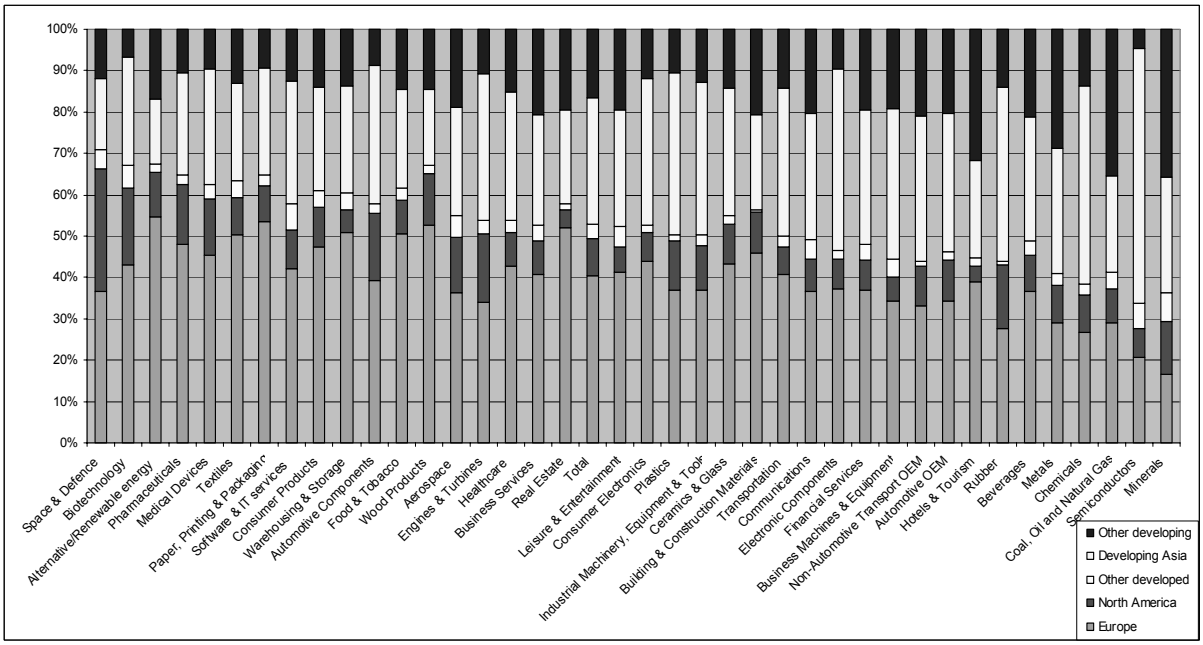
Source: Thomson Financial data base.

Figure A3.1. Transnationalisation index for a sample of MNE, 1993-2007



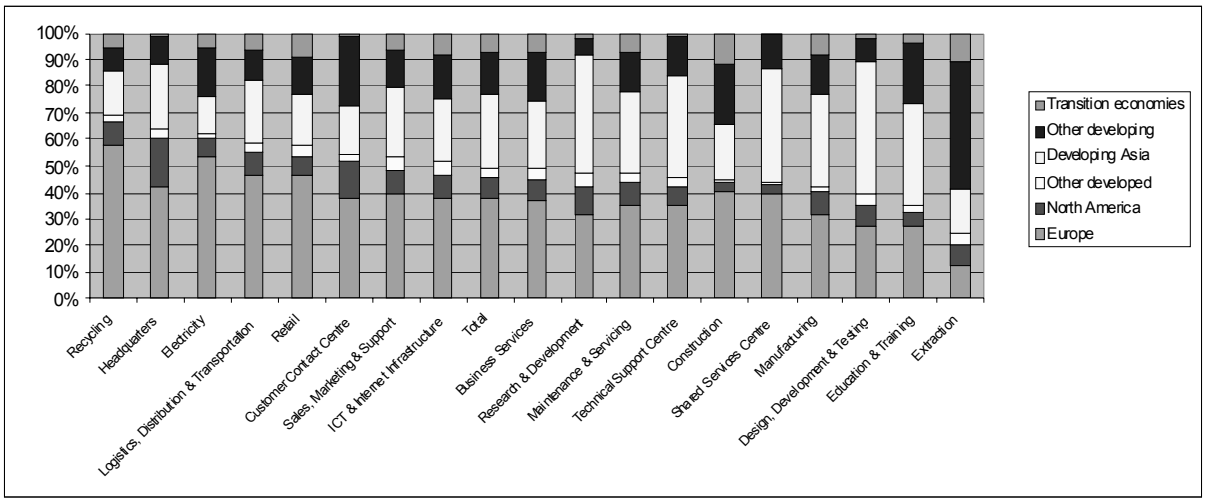
Source: UNCTAD. UNCTAD's transnationalisation index is rated as an average of three ratios for each company: the share of international assets to total assets, of international headcounts to total headcounts and of international sales to total sales.

Figure A3.2. Greenfield projects by industry and host region, 2003-July 2009



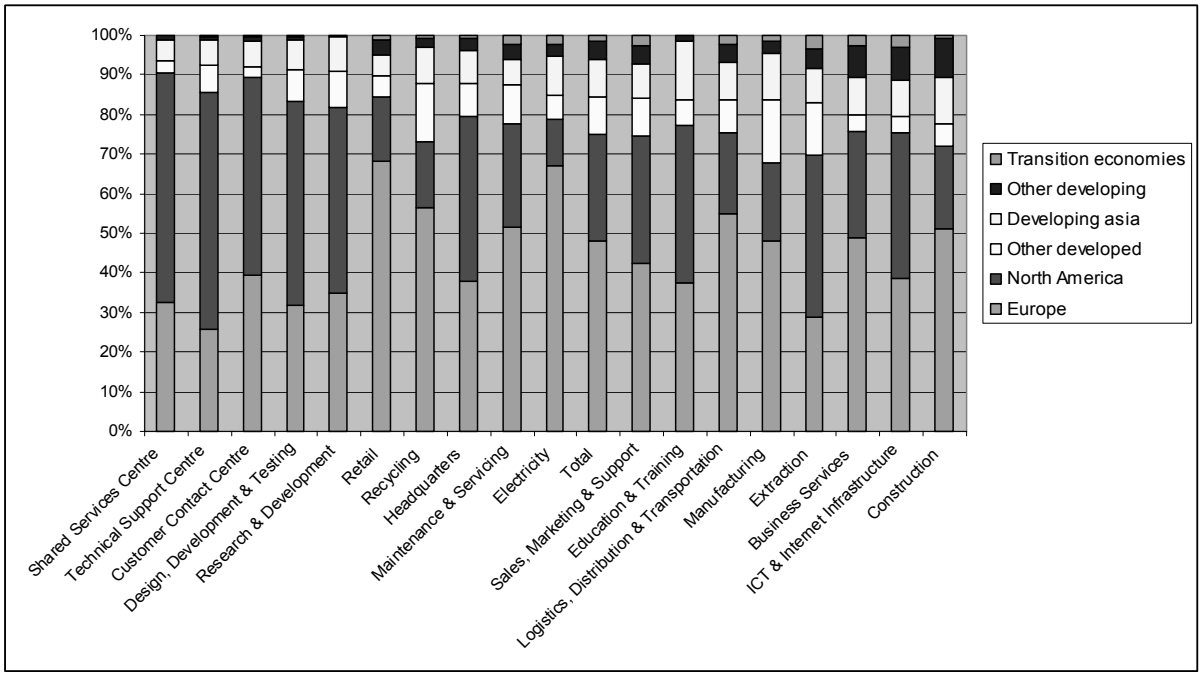
Source: OCO Consulting, FDi Markets

Figure A3.3. Greenfield projects in various business functions by host region, 2003-July 2009



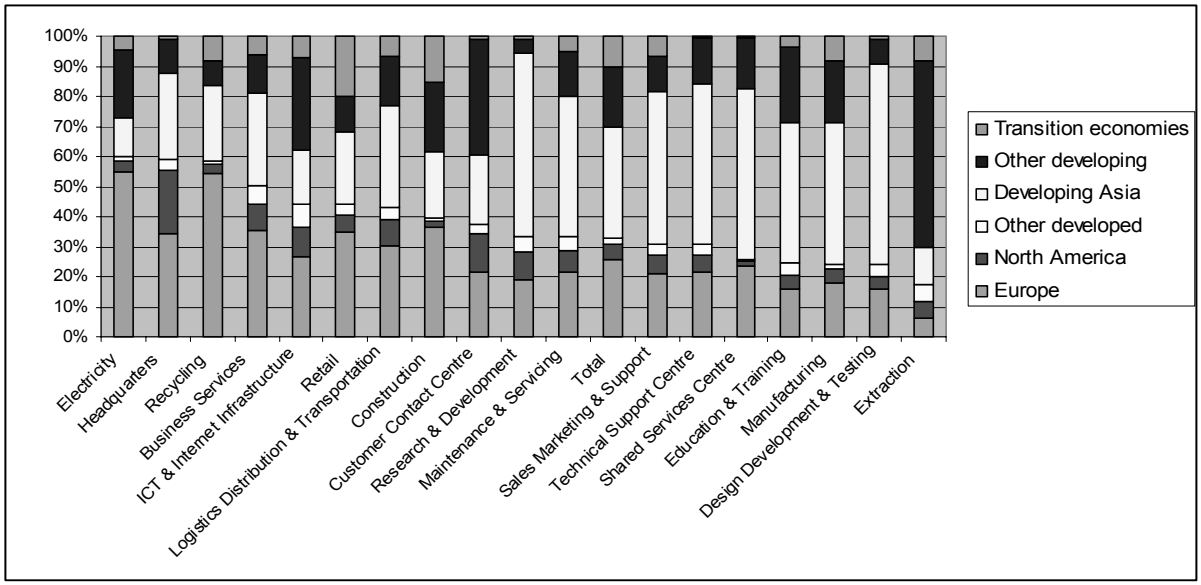
Source: OCO Consulting, FDi Markets

Figure A3.4. Greenfield projects in various business functions by home region, 2003-July 2009



Source: OCO Consulting, FDi Markets

Figure A3.5. Job creation related to international greenfield projects by home region in various business functions, 2003- July 2009



Source: FDi Markets

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